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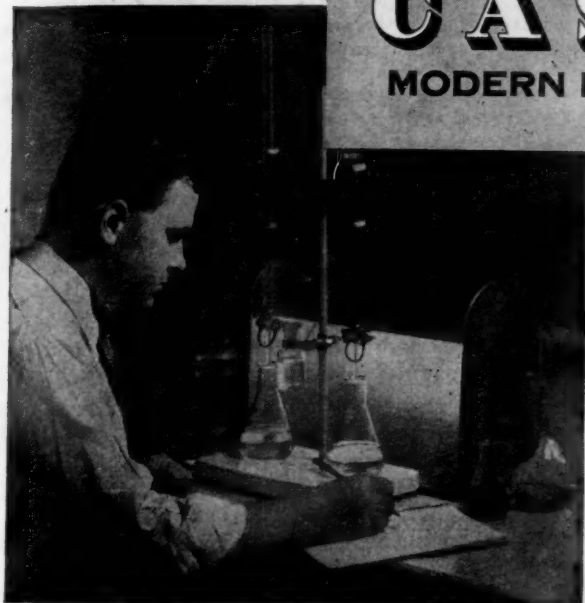
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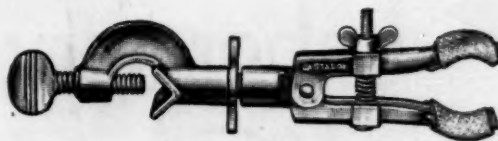
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LIFE IN THE ANDES AND CHRONIC MOUNTAIN SICKNESS

By Dr. CARLOS MONGE

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SINCE prehistoric times congenital or acquired acclimatization has made life possible upon the high plateaus of the Andes, where the altitude varies from 10,000 to 16,000 feet. At the present time twelve million people are living on these plateaus under normal conditions, at an oxygen pressure of about 85 mm instead of 150 mm as at sea-level. In considering the steady biological changes produced by ancestral acclimatization to chronic oxygen insufficiency we must assume that dwellers in these highlands belong to a climatophysiological variety of the human race, which, as observation shows, may even be responsible for

their individual attitudes and sociological behavior. Anthropological morphology does not suffice to explain life in the Andes—the fundamental basis must be found in the physiological dynamics of altitude homeostasis. If we go back to Galen we will remember that "the organism is a whole with an environment and it can not be considered apart from that environment" (Hutchins), a fact not yet established in the natural history of men in the Andes.

The claim to acclimatization acquired after a few days or weeks, "a fallacy of misplaced concreteness," misinterprets the nature of the problem and has pro-

duced much confusion. Acclimatization connotes a balanced state of the internal milieu; therefore, at high altitudes body and mind must attain the same equilibrium that man has at sea-level. To arrive at this, to overcome the otherwise impaired condition caused by chronic oxygen insufficiency, the organism calls forth its emergency adaptative devices and builds up a new chain of biological processes to stabilize its internal environment. Thus it first has to be adapted. Adaptation is in itself a malady, slow in course, generally following an acute stage—the so-called acute mountain sickness—which may be without clinical symptoms or with only mild symptoms or with the outstanding symptomatology of chronic mountain sickness. Whether the adaptative period lasts months or years, nobody knows. Probably it depends on the ability of the individual to compensate the damage caused by the permanent effects of the lack of oxygen. This is a personal equation. There are men and animals with remarkable powers of acclimatization; there are others, on the contrary, who never achieve that goal.

When the adaptation malady is over, acclimatization supervenes: so-called chronic mountain sickness has been cured.

The Native Andean and the Adapted Man. It would obviously be pretentious to try to discuss all the biological characteristics of the Andean man, whose study is only just beginning. In both the native Andean and the adapted man you will find an increase in the number of red blood cells and in hemoglobin capacity; in size of the erythrocytes (Hurtado, Talbot); in the viscosity of the blood; in resistance to hemolysis; of hematocrit; of serum proteins (Monge-Salas); of pH, but within normal limits; in the ventilation of the lungs; and in hypertonus of the vegetative nervous system (Monge, Pesce, Aste, Salazar). There will be a decrease in arterial oxygen saturation, in carbon dioxide alveolar pressure and in alkaline reserve.

And now let us consider some of these characteristics which may differentiate the adapted from the acclimatized dweller of the highlands. Talbot emphasizes the fact that the maximum oxygen capacity of some of the adapted men of the International Expedition of 1935 never reached the lower limit of dwellers acclimatized at 5.3 km altitude. Keys, Hall and Guzmán-Barrón stated that hemoglobin has less affinity for oxygen in newcomers to the highlands than in residents, that this probably accounts for the shift to the right of the oxygen dissociation curve at high altitude, and that it may be an intermediate stage in final adaptation. In regard to the alkaline reserve, Dill, Talbot and Consolazio stated that the adapted man never reaches the lower values of the acclimatized person.

Hurtado in 1932 found an increase in the capacity of the lungs, a true physiological emphysema and augmented vital capacity. On the basis of animal experimentation, he believes that the dilated pulmonary capillary affords a larger contact surface for the diffusion of gases. Mori-Chavez and I, in 1934, demonstrated in guinea pigs that the hyperplasia of the capillary bed and diminished connective arteriole structure are conditions of an acclimatized lung.

Besides the biological features, some peculiar physiological characteristics are to be observed in the Andean man. According to Rotta (1938) the cardiac index is moderately increased, the work of the heart is 20 per cent. higher, and the volume of blood is augmented. The transverse and longitudinal diameters of the heart are somewhat greater than that of the sea-level heart. The venous pressure is slightly increased. We reported in 1930-1935 that 13 per cent. of the men tested showed a heart rate of less than 50 pulsations per minute, and 41 per cent. a rate of less than 60 pulsations. But between work and heart rate there is no linear relation. After doubling the amount of work—1,400 kilogrammeters—the pulse is slower than for a basic work of 700 kilogrammeters. Of 300 normal and selected men, 27 per cent. showed practically no tachycardia after 700 kilogrammeters work, enduring the test without fatigue. Torres established the fact that arterial tension is lower at altitude than at sea-level. Thus there seem to be all the conditions of an athletic heart. Chronic oxygen insufficiency is a permanent stimulus to improve heart efficiency.

Clinical efficiency tests (Master test) show that half of the Andean men (300) are stronger than men at sea-level. The acclimatized man on the high plateaus climbs a mountain straight without difficulty. Adapted persons can never do that. For a moderate amount of physical work, a sea-level athlete in the highlands is in the same position as the untrained man at sea-level.

Grollman and Christensen have demonstrated that cardiac output during inactivity increases in the first few days of adaptation and then returns to normal. It is unfortunate that there is not available more information on acclimatized man. In the case of an adapted subject at work, Christensen found that the cardiac output and the capacity for oxygen transport were diminished. Theoretically, the cardiac output of the Andean should be considerable because of his slow heart beat and his capacity to carry on strenuous exercises.

In 50 per cent. of efficiency tests—with or without a brief tachycardia—the pulse becomes slower and then accelerates, reaching the initial normal rate. This paradoxical post-effort bradycardia, a fact never found in the physiology of the sea-level man,

has been electrocardiographically recorded (Monge-Saenz). In addition, brief periods of inverted P wave and shortness of PR, varying activity of the pacemaker, inconstant partial block and deviation of ST have been found, during which test the subject felt no fatigue. This differs from what Greene and Gilbert (1921) found in aviators during extreme oxygen want. We can assume that during the bradycardia period the heart fibers stretch to the utmost in an unaccustomed way. Heart dilatation and sudden death sometimes ensue in mountain sickness.

On the other hand, in 8 per cent. of the acclimatized subjects we found tachycardias, which started suddenly without any clinical distress, alternating with slower rates. Efficiency tests during this phase do not interfere with the initial acceleration. The pulse goes up and down keeping to the basic tachycardia, but at any moment the rate may return to bradycardia. Probably there is a sudden change in the pace-maker, but electrocardiographic records appear normal.

There is hypertonus of the vegetative nervous system, as proven by oculo-cardiac, Danielopoulo atropine and solar reflex tests (Monge, Pesce, Aste), during which the Andeans do not feel any distress at all, but the adapted men, on the contrary, frequently collapse. This explains the heart features we have just described. The increased vagal tonus, due to anoxemia, as Greene and Gilbert proved in 1921, in animal experimentation, seems to cause the bradycardia, which may be considered a feature of the altitude heart. In adaptation, after a time the slower rate probably becomes an intrinsic function of the heart muscle. The parallel activity of the sympathetic adrenal system contributes to the same result. This may explain the tachycardia of sinus origin, which constitutes another paradox of the heart rate at high altitudes. This hypertonus of the vagal-sympathetic system must have some connection with stability of the vasomotor center and reflex nervous system. Gebhorn's findings on man (1937) give an interpretation to the collapsing form of mountain sickness.

In discussing acclimatization the buffer capacity of the body has not been stressed sufficiently. The adapted and the acclimatized man have practically a similar alkaline blood reserve, but their behavior is quite different. We observed in 1928-1935 that the shift of the pH after work of about 700 kilogram-meters at high altitude either equals or is less than the values attained at sea-level. On the other hand, in adapted persons the difference in ionic concentration is three times higher. This gives an idea of the stability of the internal environment already outlined. We have established the fact of loss of alkali in men during ascent (1928). There is a reciprocal relation

between the blood alkaline wave and the elimination of bases through the urine, measured by pH, the ammonia and the titration acidity (Monge). This pH correlation between blood and urine has just been found by Brassfield and Behrmann in animal experimentation. The condition is reversed on returning to sea-level (Monge). This change must be compensated to attain a normal buffer capacity.

Very little is known about the biological processes of tissue oxygen fixation and of restoring the buffer systems. It is generally conceded that there is an interplay of chemical reactions between blood and tissues to keep the fixity of the internal milieu. At high altitude internal respiration must be conditioned by its capacity to fix oxygen and its power to buffer and to release carbon dioxide. Guzmán-Barrón, Dill, Edwards and Hurtado have suggested that there is a disturbance of the oxydation-reduction system. Hurtado found increased myoglobin. We pointed out in 1928 higher venous oxygen saturation in adapted than in acclimatized subjects. It appeared as though the tissues had not taken it from the blood. Aste-Salazar recently found facts to support this. High venous saturation may also be interpreted as an effort to maintain the capillary oxygen pressure. So we suggested, "Altitude changes the capacity of the tissues to fix oxygen. We can assume there are some unknown tissue reactions which bring about acclimatization" (1928). But this entire acclimatization hypothesis must also consider the production, buffer, transport and release of carbon dioxide.

May I suggest that the native or acclimatized highland dweller possesses some of the biological characteristics needed in an aviator, and that perhaps a better knowledge of the physiology of a man born at an altitude of 15,000 feet might contribute to an understanding of conditions of fitness required for high altitude flying?

Physiology of Reproduction. Sometimes the adapted person's body and mind seem to be in excellent condition, but, surprisingly, he may prove completely sterile. A study of the fertility of rams brought from sea-level revealed that only 50 per cent. are able to produce offspring the first year; after two or three years the highest reproductive average reaches only 70 per cent. Thus 30 per cent. sterility seems to result. Rams acclimatized since Colonial times, on the contrary, reproduce 100 per cent. Eggs brought up from sea-level do not always hatch in high altitudes.

Sterility in rabbits, cats, horses and cattle has also been found. We produced aspermatogenesis in rabbits and cats. The pathological picture resembles that of cryptorchidism. San Martin has found that some dilutors for artificial insemination do not work in high

altitudes, and this elucidates another altitude problem. If we consider these facts from an industrial point of view we can realize their importance because they affect the food supply and the economy of South American high plateaus. Similar disturbances sometimes occur in men who, though fertile at lower levels, prove sterile in the higher altitudes. History supports this observation. Father Calancha's writings (1639) describe the Spanish conquerors going to Potosí (14,000 feet) and having no offspring until fifty years after the city was founded. The mechanism, then, which enabled them to become acclimatized established itself slowly indeed. On the other hand, the average reproduction of the natives was 100 per cent. In 1639 the capital of Peru was transferred from Jauja (13,000 feet altitude) to Lima at sea-level because horses, fowl and pigs did not produce offspring at the higher altitude. Time does not permit me to give more examples.

But I do not want to create a wrong impression. The acclimatized population is always increasing. The average birth rate at 15,000 feet equals that of sea-level. We are convinced that there are both animals and plants with the superacclimatization power necessary to live on the high plateaus.

Sociological Behavior. The biological characteristics of men of the high plateaus mentioned are different from those of men at sea-level. That is why the men of the Andes may be considered as belonging to a climatophysiological variety of the human race. In fact, they are closely related to their geographical surroundings—altitude, radiation, humidity, ionization, and so on. The sociological behavior of such men and the telluric environment appear as one biological system which can not be divided, as a climatophysiological unit. So men must adapt themselves when they come down to the coast; they can not always stand the meteorological conditions of the lower lands; they become predisposed to disease of the lungs, as we have reported (1934). But the struggle for existence forces them to come down. Every year about one hundred thousand men come down to sea-level for agricultural work and then follows something worth noting: after about three months they go back to the altitudes; they never stay on the coast, no matter what it offers them. The reverse is true: if men go up to the mines, they soon return to sea-level. These peculiar annual migrations of high plateau societies are a well-known fact of biological significance. These persons are like migratory birds; they have the urge to return home. Thus, the Andean man has the same problems of acclimatization to face when going down to a land not always suited to his physiological equipment. I do not want to convey a wrong impression. Usually acclimatization on the coast is easier than in

the highlands. But there are facts, the study of which is of the utmost importance to knowledge of the Andean population: these have to do with labor, assurance, migrations, army and health. With respect to these facts history is conclusive.

During the Inca period men of the high plateaus were allowed to colonize lands of the same climates only. When the highland peoples had to fight on the coast during the wars, they had two armies which they used alternatively, thus avoiding the climatic trauma of the lower lands (Garcilazo de la Vega, Padre Cobo). The Inca's sanitary legislation as well as that of the Colonial times recognized these facts and tried to codify them. The Republic is unaware of the problem, and that is why in a recent war (Bolivia-Paraguay) the climate of the tropical lowlands of central South America killed more people than the enemy's bullets. The lessons of history have been forgotten. The day will come when those vital matters will receive due consideration for the benefit of the human beings living in high altitudes. To this end we need education and research.

CHRONIC MOUNTAIN SICKNESS

From our point of view chronic mountain sickness means non-acclimatization, that is, impaired adaptation, and also loss of acclimatization. It may pass through a severe stage, so-called acute mountain sickness. To be born at high altitude does not confer immunity. Some of the features of this disease have already been outlined. We shall consider the severe forms of chronic mountain sickness only.

In regard to its symptomatology there is a perfectly characterized type which I have called erythremia of high altitude because it exactly resembles *polycythemia vera*. We must insist upon the fact that this disease is a clinical syndrome and not a hematological pattern. We can summarize it as follows:

At rest the patient appears reddish or blue, and he turns purple at the least effort. In cases of most severe involvement the scleras are intensely colored by the distended capillaries, the eyes being hidden behind edematous and bluish eyelids. The face is blue-violet, almost black, resembling that of an asphyxiated person. The mucous membranes are reddish. The tongue appears larger than normal and full of blood. All the superficial blood vessels appear dilated. Varices are common. Epistaxis is frequent; aphonia is usually noted. The hands show clubbing of the fingers. The nails become thick and appear to be inserted like watch glasses. The person resembles an old emphysematous, plethoric patient, walking slowly and heavily. He feels extremely weak and has a marked tendency to sleep. A state of drowsiness is

found frequently. Spells of dizziness and fainting occur commonly. Nausea and vomiting at the least effort are noted occasionally; there are spells of diarrhea. Blurring of vision and temporary blindness are frequently observed. Transitory deafness occurs. Sometimes the patient suddenly falls into a kind of asphyxial coma for two or three hours, to return later to his pitiful condition. Aphonia, coughing and repeated bronchitis are present. Also recurring are congestive processes in the lungs accompanied with hemoptysis.

As the disease progresses, cardiac insufficiency ensues. In some cases symptoms of angina pectoris appear after exertion. Collapse occurs often. Hypertension happens rarely. In only two out of seventeen cases was the size of the spleen moderately increased.

Patients complain of a variety of algeias. Some of them have excruciating pains in the lower extremities; others have constant pain in the lumbar region or in the joints, particularly in the tendon attachments at joint cavities. These pains may subside spontaneously or may cease if the patient descends to a lower altitude. There may be violent cephalagia, subsiding after lumbar puncture or bleeding. Bleeding improves the condition immediately in such cases. Paresthesias are varied in type and in localization. Some patients complain of unpleasant sensations of heat in the face; others, of violent sensations of cold. One said he felt as if warm water were being thrown on his back. One had the sensation of the loss of one hand; another complained of "bandaged legs." Formication and sensations of being pricked by pins are frequent. Those symptoms are similar to aeroembolism, as described by Armstrong.

Some persons are rather predisposed to congestive cerebral syndrome (Monge, 1936). This appears as a spasm of painful headache, sensation of fullness of the head, of hot flushes on the face, photophobia, injection of ocular mucosa and blurring of vision, scotoma, lacrimation, vertigo, dizziness, pain in the abdomen, general sweating and vomiting. The pulse becomes slower. Cyanosis is intense. These crises may last some minutes or several hours. When this occurs, the patient sinks into drowsiness which passes into unconsciousness. Frequently, an epistaxis releases the stuporous condition and the patient improves. The spinal fluid pressure is remarkably increased. In a recent case, Arellano found that the spinal fluid pressure surpassed the highest mark of the Claude manometer. Repeated lumbar puncture relieves the patient. This syndrome may be interpreted by considering the recent findings of Armstrong, Michelsen, Thompson and Maurer, who observed an increase of spinal fluid pressure in animals exposed to anoxia. Walsh and Boothby, in a low-

pressure chamber, have seen bubbles appear in man and have noted increased spinal fluid accumulation. Arellano's case and our findings (1938) probably have the same explanation. Hemiplegia is not uncommon. After a sojourn of several years at 4.6 km one patient developed the symptomatology of moderated erythremia. Suddenly one day he developed a moderate degree of palsy of the right arm and aphasia. After a few minutes the disturbance disappeared. Every morning thereafter the trouble returned and the patient was obliged to come down to the capital. He showed some impaired mental and physical condition, but after a few days appeared normal. Two months later he returned to the mountains, but after three weeks the trouble reappeared. The last time he went up he developed deep psychic disturbances, a confused mental state and symptoms of acute soroche. He was brought to the coast against his will. A few days later he was entirely recovered, but he could not remember what had happened. He was obliged to give up his work in high altitudes.

In a recent case, after several years of erythremic symptoms the patient found himself unable to work and he had a fear of traveling. He worried much about this. He said it was "a silly idea" but he could not help it. He saw everything wrong; he was afraid of meeting his employees at the saw-mill. Sometimes he got up at night and went to work; he realized that there was nothing to do, but he went there just the same. Finally he felt like a "criminal" or a "murderer" and he conceived the idea of committing suicide. Then he came down to sea-level and was immediately relieved; the mental disturbances disappeared. When he returned to the highlands the idea of suicide persisted. Under the circumstances, we kept him in Lima, where he was completely normal. In cases of severe involvement there may be marked disturbances in the behavior and memory of the patients. An engineer had attacks of mental confusion during which he would make gross mistakes in arithmetic and drawing. Even with knowledge that descending to sea-level would effect a cure, he could not take the initiative to make the trip.

Nervous exhaustion is very common. The patients complain frequently of sexual frigidity. We have seen albuminuria vanish when patients were brought to sea-level and return as soon as they went back to high altitudes. We have found persons with a syndrome of recurrent collapse, hyperventilation and attacks of tetany, who entirely recovered when brought to a lower region. Similar condition has been found by Hinshan and Boothby in aviators. Marked polycythemia is the characteristic feature in these patients, the red blood cells being as a rule between 7,000,000

to 9,000,000 in number and of larger size than at sea-level. The number of reticulocytes is increased also. There is a slight leukocytosis and eosinophilia. There is a predominance of monocytes. Alterations in the process of clotting are observed. One patient had bleeding of the gums, but this disappeared as he went down to a lower level. In another case the patient had convulsive attacks accompanied by pupura and the presence of blood in the cerebrospinal fluid, all of which disappeared when he was brought down to sea-level. The bilirubin is highly increased. The pH of the serum diminishes during asphyxial attacks, while after the crisis has passed, it goes up to 7.50-7.70 (Aste-Salazar¹). The alkaline reserve of the plasma is greater than that of a person who is acclimatized to high altitude. The concentration of hemoglobin in the blood is considerably increased, in one case reaching 179 per cent. (taking 100 as the value found at sea-level). The viscosity of the blood is increased. There is high blood volume (Hurtado) and diminished plasma volume. The oxygen saturation of the arterial blood is considerably decreased. Hurtado found 57 per cent. in one case, and Aste from 70 to 80 per cent. High venous blood saturation reaches normal levels when the patients improve at sea-level. High basal metabolism is found in severe cases.

Evolution of the Disease. As a rule the patients consult a physician only after the illness has been present for some time, and it can last usually from two to twenty years. Sometimes a patient becomes temporarily well even while staying at a high altitude.

Usually, after a stay at sea-level a patient returns to a high altitude and lives there for some time without great discomfort. As time goes on, however, the cure at sea-level is less and less enduring, and asphyxial disorders may occur as soon as the patient reaches a high altitude. These disorders may sometimes cause death.

From this condensed description it is seen that the fundamental characteristic of high altitude disease, the characteristic which has made us group it as a nosographic entity, is the fact that all the symptoms subside or disappear as soon as the patient is brought down to sea-level. This feature is undoubtedly due to a common cause, anoxemia. The predominance of any symptom must be due to the fact that the particular organ involved has suffered great damage from the prolonged effects of lack of oxygen.

Besides these severe forms of chronic mountain sickness there are cases of subacute evolution, with slight impairment of physical and psychical conditions and a mild erythremic symptomatology.

At times one can find some individualized forms: pulmonary, cardiac, renal, digestive, etc. But a skillful clinician can always differentiate an erythremic complex. Silicosis, however, frequently displays an exaggerated symptomatology of chronic mountain sickness.

In conclusion it may be said that we have found a climatophysiological variety of human being and a climatopathological variety of human disease. But our work represents only a tentative effort in fields of education and research that are still unexplored.

LOW TEMPERATURE PHYSICS IN THE USSR

By Professor C. T. LANE

YALE UNIVERSITY

THE extraordinary performance of the Russians on the Eastern Front has been a surprise to many people in this country. We had supposed that most Soviet industry was badly managed and Russian technicians, as a whole, inept. Those of us, however, whose interest in certain scientific fields had compelled us to pay some attention to Russian research were, I think, agreed that much of this work was of a high order and comparable in quality with the best American and British effort. Generally speaking, any nation with a healthy interest in pure research is likely to have a vigorous industry, and *vice versa*.

In the special field of low temperature physics Russian contributions both in the pure and applied domain merit special attention. At least two excellently equipped laboratories for such studies have

been built in the past ten years. The best known of these is the Institute for Physical Problems at Moscow under the direction of P. L. Kapitza, but excellent work has also been done at the Physico-technical Institute at Kharkov under W. Schubnikov. It is probably a fair statement of fact to say that Kapitza is the most distinguished of all present-day Soviet physicists. He first appeared in England during the twenties at Cambridge, and, with Rutherford's backing, had very soon perfected an apparatus for the production of magnetic fields some ten times more intense than anything previously attained. During the period 1926-1930 a considerable number of fundamental papers on the properties of metals in high fields appeared from Cambridge. About 1929 Kapitza's interest appears to have shifted to low temperature work, probably because he recognized that such studies

¹ Unpublished work.

would be of prime importance in furthering our understanding of the metallic state. With funds supplied by Sir Alfred Mond he created, practically single-handed, the Royal Society Mond Laboratory at Cambridge for low temperature work. Almost all the equipment at the Mond is of a radically new design, and special mention should be made of the Kapitza helium liquefier there.

This machine marks a new epoch in the technique of gas liquefaction, and for the first time opened up the region of extremely low temperature research to smaller laboratories whose funds do not permit the expensive and highly specialized equipment previously necessary. The Mond liquefier was followed by one of similar type, designed by the writer, and built at the Sloane Physics Laboratory, Yale University.

Apparently Kapitza was in the habit of spending his summers in Russia, and in the fall of 1935 he failed to reappear at Cambridge for the fall term. The story current at the time was that he had been "detained" by the Soviet authorities, who explained that they needed his outstanding talents for Russia's own highly important and rapidly developing scientific work. However, in a letter to the writer in 1937, he stated that he had resumed his scientific work and seemed quite satisfied with his position in general. As head of the Institute at Moscow Kapitza has gone ahead in several directions in the low temperature field. He has built another helium liquefier based on his Cambridge design and equally successful. Although no technical details concerning this plant apparently have been published¹ it appears to be of somewhat better design than either the Cambridge liquefier or the Yale plant, and is probably the best liquid helium equipment in the world to-day.

A second outstanding piece of work has also come from his laboratory, and this merits our special attention since it apparently represents part of a widespread program in the USSR linking low temperature physics and industry. The Russians have instituted a new branch of engineering which they call "deep refrigeration," and much of this program appears to be under Kapitza's direction.²

This new industry is really an extension of one which has been practiced all over the world for a number of years (in one restricted field) namely, the production of oxygen, nitrogen and argon from atmospheric air. The Russians have been the first to realize that enormous quantities of valuable raw materials go to waste annually in various gases which are by-products of many industries. The problem has been to separate out the various pure components of these usually complex mixtures and so make available to the chemical industry an abundant source of raw

materials for the manufacture of plastics, synthetic rubber, etc. Low temperature separation, i.e., the progressive liquefaction and removal of the various components of a mixture made possible by the fact that each component has a different liquefaction temperature, has been found to be a very economical and practical method. It is clear, therefore, that any advance in the technique of gas liquefaction, while interesting scientifically, is likely to have an even greater industrial significance.

To return to Kapitza, he has recently perfected a new type of liquefaction apparatus which is quite different from anything so far attempted anywhere. While it has officially been applied only to the production of liquid air, it seems certain that the Russians are making wide use of it in their chemical industry, probably in plants making synthetic rubber and explosives. The actual machine, which makes use of a special type of low temperature turbine, is too complicated to be discussed in much detail in such an article as this, although some technical information is available.³ The suggestion that a turbine might be a valuable type of machine for gas liquefaction is, to be sure, not a new one. It was originally due to the eminent English physicist, Lord Rayleigh, about the close of the last century. However, it soon became apparent that a practical turbine would have to run at an enormous speed, some 30,000 r.p.m., to be efficient, and at such speeds vibration becomes a serious problem. It remained for Kapitza to overcome these formidable technical difficulties, and the resulting apparatus appears from the published accounts to be very reliable and of exceptional efficiency. One enormous advantage lies in the fact that it operates at very low pressure while existing liquefaction equipment does not. This means that for large-scale equipment the cheaper and more efficient turbo-compressor could be used in place of the cumbersome and expensive multi-stage piston compressors now employed. It is probably not too much to say that all existing low temperature industrial equipment has been rendered obsolete by this development. In recognition of the importance of this work the Russian Academy of Sciences voted Kapitza a bonus of 25,000 rubles, together with premiums to his assistants.

While we are on the subject of low temperature physics in industry, it may be worth mentioning that another Russian physicist, M. Ruhemann, has recently published a most illuminating book on the whole subject of gas separation by refrigeration.⁴ Ruhemann is a product of the Kharkov Institute and judging by the number of publications by him on the subject which have appeared in various English and Russian

¹ A photograph of the plant appears in *Phys. Zeit. d. Sowjetunion*, 12: 497, 1937.

² *Nature*, 148: 360, 1941.

³ P. Kapitza, *Jour. Physics, USSR*, 1: 7, 1939.

⁴ "The Separation of Gases," New York: Oxford University Press, 1940.

journals, he also has taken a leading part in the establishment of this new industry. The book is highly technical, but would certainly repay close study by any one interested in this field.

One instance, apart from gas separation, of some of the problems which have been solved in the USSR should prove of interest to scientists in this country. The so-called "natural gas" found in and adjoining oil fields consists largely of methane. This gas is much superior to ordinary illuminating gas in calorific value, but, more surprising, it is an excellent anti-knock fuel for internal combustion engines. The difficulty lies in storage, since a cylinder designed for 150 atmospheres pressure weighs about ten times more than the methane it contains. However, a tank $20 \times 15 \times 10$ feet could hold as much methane (liquid) as a two million cubic foot gas-holder and would be immeasurably cheaper and less dangerous. The advantages of such a scheme are obviously very great—such stored gas would be of great value in emergencies or when sudden and heavy industrial demands on fuel gas occur.

Despite all this industrial activity in recent years, a good deal of purely "academic" research of high quality has come from Kapitza's laboratory. One such outstanding contribution was made during the current year and reported in the *Physical Review*. This had to do with the properties of liquid helium. Kapitza had earlier discovered that liquid helium at a temperature some two degrees above absolute zero (so-called Helium II) behaves like an "ideal" fluid, apparently possessing a vanishingly small viscosity or fluid friction. It appears from this latest work that Helium II flows in narrow channels without change in entropy and accordingly is truly a super fluid. We must therefore regard this substance as being unique—nothing like it has ever been previously observed. The significance of this discovery for modern atomic physics is likely to be of the greatest importance.

The whereabouts and activities of Kapitza since the German invasion are not known. It is probable that his purely scientific work has been interrupted although likely that he is still engaged in his industrial activities.

THE NATIONAL ROSTER OF SCIENTIFIC AND SPECIALIZED PERSONNEL: THIRD PROGRESS REPORT

By Dr. LEONARD CARMICHAEL

PRESIDENT OF TUFTS COLLEGE, DIRECTOR OF THE NATIONAL ROSTER OF SCIENTIFIC AND SPECIALIZED PERSONNEL

IN previous reports¹ an outline has been presented of the basic plan and the preliminary steps taken in the construction of the National Roster of Scientific and Specialized Personnel. In the present report emphasis is given to a description of the actual operation of the Roster as it appears at the close of the first year of performance.

So far, more than 200,000 names of individuals are listed in the analytical files of the Roster. It is interesting that from this list already more than 50,000 names have been presented to various defense agencies and other government bureaus for consideration in connection with appointments. Almost all the requests that come to the Roster office are of a confidential character and it is not possible at this time to describe them. It can be said, however, that especially large numbers of demands have been presented for individuals in the fields of physics, electrical engineering, aeronautical engineering, marine engineering and mechanical engineering. Significantly large numbers of requests have also been received for individuals

with special language skills or with a combination of some other professional competency and language skill. There have been demands also for a good many economists and psychologists, and, indeed, there have been some requests for men in each of the fields covered by the Roster. The fields for which technical check lists have so far been prepared are as follows:

Administration and Management, including separate lists in:

Accounting
Management Engineering
Personnel Administration

Agricultural and Biological Sciences, including separate lists in:

Animal Sciences
Botany
Forestry and Range Management
Genetics
Plant Pathology, Horticulture and Agronomy
Zoology and Entomology

Engineering and Related Fields, including separate lists in:

Aeronautical Engineering
Architecture

¹ SCIENCE, August 16, 1940, Vol. 92, No. 2381, pages 135-137, and SCIENCE, March 7, 1941, Vol. 93, No. 2410, pp. 217-219.

Automotive Engineering
 Chemical Engineering
 Civil Engineering
 Electrical Engineering
 Heating, Ventilating, Refrigerating and Air Conditioning Engineering
 Industrial Design
 Mechanical Engineering
 Mining and Metallurgical Engineering and Mineral Technology
 Motion Pictures—Engineering, Production, Direction
 Naval Architecture and Marine Engineering
 Radio Engineering
 Safety Engineering
 Testing of Materials—Engineering and Technology
 Transit and Traffic Engineering

Humanities
 Foreign Languages

Medical Sciences and Related Fields, including separate lists in:
 Anatomy
 Bacteriology, Immunology and Pathology
 Nutrition
 Pharmacology and Experimental Therapeutics
 Physiology
 Tropical Medicine (and Parasitology)

Physical Sciences, including separate lists in:
 Actuarial Science
 Chemistry
 Geology
 Geophysics
 Horology
 Mathematics
 Physics and Astronomy

Raw and Manufactured Products and Associated Industries:
 Speleology

Social Sciences, including separate lists in:
 Anthropology
 Economics
 Geography
 History and Political Science
 Psychiatry
 Psychology
 Recreation Leadership
 Sociology
 Social Welfare
 Speech Pathology
 Statistics
 Trade and Industrial Education

A few examples of the sort of requests which come to the Roster from non-confidential sources may give an indication of the character of demands in the confidential areas as well.

The Bureau of Mines of the Department of the Interior requested names of chemical engineers skilled in extractive metallurgy, especially in the field of aluminum.

The Interstate Commerce Commission requested a

transportation economist capable of assuming responsibility for conducting independent research and using statistical data in the investigation of the economics of transportation.

An investigating committee of the United States House of Representatives requested the names of experts in the fields of economics, sociology, transportation and job statistics to perform research and analysis in connection with national defense migration.

The Office of Price Administration and Civilian Supply requested a number of mathematical statisticians.

Engineers of various types have been requested for the Panama Canal Zone.

The Office of Production Management has requested, under specific description, more than thirty economists skilled in such fields as brass, cadmium, hides, rubber, cork and miscellaneous metals.

The National Youth Administration requested the names of individuals eligible for appointment as radio engineers to provide advisory service to state administrators in connection with the training of young radio operators.

From the Securities Exchange Commission a request for statisticians in securities and corporate finance has been received.

The examples given above hardly give a fair picture of the work of the Roster because by far the largest number of individual requests that have come to the office have been from the Army, Navy and other services in which information is at the present time restricted. Nevertheless, these examples may show something of the highly specific character of the demands which are made upon the Roster concerning citizens who have had very specialized training.

Some of the individuals for whom confidential requests have come are: translators of many languages; maritime reporters; physical chemists; radio physicists; industrial chemists; women physicists; explosives chemists; specialists in European history; electrical, mechanical, chemical, civil, sanitary, safety, aeronautical, marine, motion picture, and other engineering specialists; business specialists; personnel administrators; petroleum economists; statisticians with ability to speak Spanish; research physicists with experience in testing strength of materials; recreation supervisors; topographers; accountants; industrial commissioners; economists for monetary research; economic geologists; physicists with expert knowledge of oscillographs; psychologists for personnel testing; physicists for research in optics; safety experts; experts in hydro-dynamics; psychologists with expert knowledge of vision and audition; x-ray experts; public administrators; labor representatives; indus-

trial training coordinators; experts on import and export problems of clearance; experts in labor relations; ordnance experts; nutrition chemists; speech pathologists; physiologists with experience in high altitude research; budget examiners; architectural inspectors; examiners with knowledge of Polish; personnel placement officers; and many others.

From time to time those in charge of the administration of the Roster have secured statistical data concerning its growing file. At one time, for example, the percentage of men and women listed was determined for the entire file. While names have been added since that time, it is presumed that this ratio has not changed materially. The numbers indicated are: men, 142,845; women, 8,881. The median age of Roster registrants, based on a similar procedure, was found to be 37.65.

At the time when the total registration of the Roster included 151,726 individuals, a study was made of the distribution of those registered by professional field, and at the same time a study was made of the academic training of those registered. It should be emphasized that selective factors have determined the academic level of the individuals listed on the Roster. For example, circularization in certain fields of the humanities has been limited to those who have pursued studies equivalent to those ordinarily required for the Ph.D. degree, whereas in other fields all individuals who have received Bachelor's degrees and whose names could be secured by the Roster have been listed. It should be added that there are no minimum educational requirements for inclusion in the Roster. The number of individuals in various fields and their educational level are given as of September 1, 1941, in the table below.

Dr. Stuart H. Britt, of George Washington University, has been serving as a special consultant of the Roster to deal with the problem of the relationship between the Roster and the Selective Service System. After consultation with leading academic authorities in the fields of specialization for which there is the greatest demand because of the defense effort, Dr. Britt has worked out a procedure by means of which information on the Roster concerning a man's accomplishments may be made available, through the national and state boards, to the local boards of the Selective Service System for their own evaluation. Emphasis should be given to the fact that this relationship between the Roster and the Selective Service System is wholly of an advisory character. The procedure employed by the Roster in this work has been to use the selecting card sorter and to tabulate the names of those individuals on the Roster whose age is such that they are subject to call by the action of the Selective Service System. Special questionnaires

are forwarded from the Roster office to these individuals requesting information concerning their status with their local boards. On the basis of this information and information contained in the individual's questionnaire as originally filled out, authorities in the man's special field are asked to advise the Roster concerning the training of the man in question in relation to necessary defense work. The registrant's employer, as well as others having knowledge of his

DISTRIBUTION OF INDIVIDUALS REGISTERED WITH THE NATIONAL ROSTER OF SCIENTIFIC AND SPECIALIZED PERSONNEL BY PROFESSIONAL FIELD AND EXTENT OF EDUCATION SEPTEMBER 1, 1941

Field of specialization	Extent of education					Total
	Doctor	Master	Bachelor	4 Yrs. Coll. No Degree	Others	
Languages	2,785	1,607	1,598	116	566	6,672
Genetics	435	164	82	13	61	755
Zoology	1,500	975	597	28	294	3,394
Physiology	554	50	13	1	...	618
Botany	741	247	79	3	6	1,076
Bact., Immu., Path.	1,384	349	369	25	56	2,183
Anatomy	484	25	13	1	3	526
Tropical med.	245	30	18	...	5	298
Chemistry	7,345	7,378	19,093	1,242	3,394	38,452
Physics	2,507	1,679	1,335	82	218	5,821
Mathematics	1,502	1,838	880	31	44	4,295
Geology	932	1,020	1,996	147	484	4,579
Actuarial sci.	9	96	278	8	100	491
Speleology	17	6	13	2	26	64
Horology	16	2	663	681
Civil eng.	135	1,616	5,825	291	1,357	9,224
Marine eng.	4	76	313	51	269	713
Safety eng.	9	41	366	59	585	1,060
Traffic eng.	2	31	125	8	100	266
Radio eng.	108	348	905	73	704	2,138
Testing mat. eng..	70	211	567	36	237	1,121
Chemical eng.	331	595	1,915	138	317	3,296
Electrical eng.	228	1,339	5,402	219	1,205	8,393
Mechanical eng.	117	1,055	4,500	288	1,478	7,438
Motion Pict. eng..	2	12	69	9	124	216
Automotive eng.	48	215	1,047	99	1,145	2,554
Aeronautical eng..	55	328	1,627	139	988	3,137
Management eng..	103	309	1,136	98	1,114	2,760
Heating and vent. eng.	19	159	851	95	696	1,820
Mining and met. eng.	335	856	2,733	154	612	4,690
Economics	1,103	867	425	17	105	2,517
Accounting	1	42	176	36	393	648
Psychology	1,957	1,013	181	7	10	3,168
Anthropology	281	147	95	14	32	569
Hist. and pol. sci.	2,120	1,367	413	17	64	3,981
Personnel adm.	348	1,350	1,178	100	608	3,584
Speech pathology..	70	110	39	...	10	229
Statistics	595	615	517	29	108	1,864
Geography	231	171	98	8	56	564
Sociology	472	301	133	4	23	933
Recreation leadership	33	311	650	52	185	1,231
Plant path., hort. and agr.	1,020	839	642	21	69	2,591
Forestry and range mgmt.	136	982	2,272	71	418	3,879
Animal sciences ..	350	684	5,887	57	259	7,237
	30,723	31,454	66,467	3,891	19,191	151,726

technical competences, is also asked to furnish information concerning his qualifications.

It is recognized that especially because of the changing activities brought about by the national emergency, information secured a number of months ago may rapidly become obsolete. The Roster has, therefore, arranged a procedure by means of which the

entire card index may be run through and those cards selected which have been in the files for twelve months. All such individuals receive a special abbreviated questionnaire asking them to fill in blanks which indicate changes in status which have occurred during the previous year. This recircularization procedure is just beginning.

Because of the fact that many of the demands that come to the office of the Roster require the services of young scientists with advanced training, it has been decided this year to add to the lists of the Roster the names of all young men and women who are expected to graduate from colleges and technical schools in 1942, provided they are carrying on major work in physics, mathematics, astronomy, chemistry, geology or any of the engineering fields.

Recently, due to demands from the Office of Production Management, special procedures have been worked out by means of which accredited governmental agents may use the facilities of the Roster in connection with the needs of rapidly developing private defense industry. In this work, as in all other aspects of the operation of the Roster, every effort is made by the staff and by the scientific and technical consultants, who are called together for the purpose, to emphasize the conservation aspects of the work of the Roster. If it were not for the limits imposed upon the office because of the confidential nature of the work which the Roster carries out, it would be possible to give hundreds of examples of individuals who have been allowed to continue in educational work, defense or even non-defense research of an important character as a result of the opera-

tion of the Roster. This means that by using the large lists available in the Roster office, it is possible to suggest alternative names to individuals who are very anxious to call from one defense agency to another some important man. In a similar way, going enterprises in education and public health research, for example, have been safeguarded.

It is clear that the work of preliminary evaluation and of consultation with various defense agencies requires continued and active supervision. The writer of this report is in Washington on an average of only two or three days each week, so the general burden of the development and effective administration of the Roster in all its aspects falls upon Mr. James C. O'Brien, who from the first has been the efficient executive officer of the project. There are slight fluctuations in the number of individuals employed in clerical and other capacities in the Roster office, but the average figure of those employed may be set at 100.

The writer can not resist once again emphasizing the fact that the Roster seems to have so many implications for peace-time as well as war-time economy that it is our profound hope that this new and effective agency for dealing with America's highly trained citizens may not be thought of wholly in war terms, although at the present time almost all its activities are specifically of a defense character. It seems quite clear to those who are working with the Roster that in time of peace as well as in war a great central list of this sort will be advantageous to the country as a whole and especially advantageous to the scientists and specialized workers who are listed on the Roster.

OBITUARY

ELSIE CLEWS PARSONS

DR. ELSIE CLEWS PARSONS, president of the American Anthropological Association, died on December 19 after an operation, just before she was to preside at the annual meeting of the association.

Dr. Parsons' anthropological work is outstanding both by the quality and the wide extent of her contributions. Her early publications on sociological questions relating to our present civilization were in part influenced by the teachings of Giddings, but reflected at the same time her intense devotion to individual freedom. She was one of the early champions of the rights of women, a vigorous opponent of the recognition of any form of status to which a person is born or assigned, and she lived her life according to her convictions, which demanded social responsibility combined with individual tolerance.

Later on she turned to anthropological studies of a different character, largely prompted by the feeling

that we need an understanding of foreign cultures in order to enable us to evaluate clearly the problems that have to be solved in our own civilization. Her interest was challenged, perhaps accidentally, by observation of the Indians of New Mexico and Arizona. The contrast between their cultural behavior and our own, the influence of cultural forms upon personalities, the ways in which personalities similar to those found in our own civilization respond to the demands of their culture, were problems that challenged her attention. Combined with this was an insatiable demand for ample and reliable factual information for supporting her deductions, which accounts for her prolific writings.

The study of the ceremonials, customs and folk-lore brought home to her the importance of the influence of Spanish civilization upon the American Indian, and with ever-expanding appreciation of the importance of this problem she extended her work over other

Spanish-American countries. One of the most mature results of these studies is her book on Mitla, a Mexican town in which ancient attitudes and Spanish influences are blended in a remarkable way. Her very last investigation, which she had just completed, bears on the same subject as expressed among the Indians of Ecuador.

Her two-volume work, "Pueblo Indian Religion," published in 1939, contains a summary of practically all we know about Pueblo religion and is an indispensable source book for every student of Indian life. Besides the results of her own investigations it contains a critical summary of the vast literature related to this subject.

It is impossible to do justice to all her writings, every one of which shows her painstaking desire for accuracy and furnished new materials for her own studies and for those of others. Her own investigations extended not only over the Pueblos, Mexico and recently also South America, but she also collected among American Negroes in the United States as well as in the Bahamas, Haiti, the Lesser Antilles Islands, among the Portuguese in New England and many Indian tribes of the Plains.

The importance of her work should not be judged alone by the quantity of reliable and carefully digested material but even more so by the uses to which she put the results of her investigations. She was one of those whose scientific insight shapes their life. Conscious through her studies of the far-reaching influence of tradition, she was averse to the ardent spirit that would throw aside the past and rebuild society on theoretical grounds; an enemy of all catch phrases that beguile us and skeptical of the beautiful words that promise a better future, but that are not liable to be kept by those who glibly pronounce them, not as she believed on account of their bad faith, but because freedom of the mind and willingness to forego old accustomed prejudice must be attained before we can hope for a better future.

In Elsie Clews Parsons we have lost not only an unusually productive and painstaking scholar but also a woman who used her great opportunities wholeheartedly in furthering the science in which she was interested. She followed the work of the younger students with keen interest, and wherever it was in her power

she helped them unstintingly to carry on their work, both with material means and with sound advice, without expecting any return except opportunity well used. Social science in all parts of the country owes her an unmeasurable gratitude. It is not saying too much to claim that the successful work of the American Folk-Lore Society could not have been done without the energy and time that she put into it.

She was in every way a power for good in our society. She will be sorely missed by all her friends, and her death is a loss to the nation.

FRANZ BOAS

COLUMBIA UNIVERSITY

DEATHS AND MEMORIALS

DR. HARRY WARD FOOTE, professor of physical chemistry at Yale University, a member of the faculty for the past forty-two years, died on January 14 at the age of sixty-six years.

DR. ALFRED SIMPSON TAYLOR, professor of clinical surgery in the department of neurology of Cornell University Medical College, died on January 16 at the age of seventy-three years.

PAUL GOODWIN REDINGTON, forest supervisor of the U. S. Forest Service, formerly chief of the U. S. Biological Survey, died on January 12. He was sixty-three years old.

CHARLES ANDREW McCUE, dean of the School of Agriculture, formerly professor of horticulture of the University of Delaware, died on January 12 in his sixty-third year.

PROFESSOR ÉMILE PICARD, permanent secretary of the Paris Academy of Sciences and a distinguished mathematician, died on December 12, aged eighty-five years.

THE centenary of the birth of William James was observed at the University of Wisconsin on January 12 and 13 by a meeting at which 600 philosophers and students of philosophy were present. Among the speakers were: Dr. J. Seelye Bixler, of Harvard University; Dr. Boyd H. Bode, of the Ohio State University; Dr. Max Otto, of the University of Wisconsin, and Dr. Dickinson S. Miller, formerly of Columbia University. A paper by Dr. John Dewey, who is spending the winter in Florida, was read.

SCIENTIFIC EVENTS

ADJUSTMENTS IN THE EDUCATIONAL PROGRAM AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

AN official statement has been issued by the Massachusetts Institute of Technology announcing that it does not plan to adopt the extreme "speed-up" plan

which many colleges have adopted as a war emergency measure. The Corporation approved on January 9 a faculty recommendation to this effect. After careful analysis it has been decided that adoption of the "speed-up" plan would weaken rather than strengthen the total contributions of the institute to the war

effort, and would retard rather than expedite effective service by its students. This decision was arrived at after wide discussion with Army, Navy and industrial officers who are thoroughly aware of the urgent need for well-trained engineers and scientists.

In discussing this decision President Karl T. Compton pointed out that the principal objection to the "speed-up" plan which contemplates continuous concentrated college study, summer and winter after secondary school graduation, is that the additional yield would consist at the most of only about twelve thousand engineering graduates in the entire country, no difference for how many years the "speed-up" program is continued, and this gain would be offset by their inferior training and by necessary curtailment of the special emergency training courses through which the engineering colleges are now turning out technical specialists in much larger numbers than they are graduating regular students.

The need for well-trained engineers and scientists is recognized by the Selective Service Administration, which recommends that students in these fields, who give evidence of professional promise, be permitted to complete their academic programs. Similarly Britain has been forced, through the technical requirements of the war, to place scientists and engineers in special categories—even to the extent of forbidding their engagement in the war effort outside the field of their professional competence.

Though not favoring the extreme "speed-up" plan, the faculty of the institute voted to accelerate the program for this year's senior class to permit graduation on April 27, and has authorized substitution of special study and training in subjects important for the war effort in place of certain professional and non-professional requirements of the normal curriculum.

THE FINLAY INSTITUTE OF THE AMERICAS

ACCORDING to the *Journal* of the American Medical Association, at a meeting on January 6 at the Medical School of the University of Havana, it was decided to establish "The Finlay Institute of the Americas to encourage research and education in the field of tropical disease and to provide for an increased interchange of medical students and teachers among scientific medical institutions in all the American nations." Officers were elected as follows: Basil O'Connor, president of the National Foundation for Infantile Paralysis, president of the executive council; Dr. James E. Paullin, president-elect of the American College of Surgeons, chairman of the Scientific Advisory Committee for the United States. Members of the executive council include: Dr. Thomas Mackie, president of the American Society of Tropical Disease; Dr. Morris Fishbein, editor of the *Journal* of the American Medical Association; Dr. Edgar Mayer,

associate professor of medicine at Cornell University and the University of Havana; Dr. Enrique Saladrigas, director of the Finlay Institute of the University of Havana; Dr. Rafael Menocal, professor of surgery at the University of Havana, and Dr. Felix Hurtado, assistant minister of public health of Cuba. During the course of the negotiations for the establishment of the institute Mr. O'Connor presented to President Batista of Cuba and to the minister of public health, Dr. Marruz, messages from President Roosevelt and Vice-President Henry Wallace, indicating their approval of the project to foster more intense cooperation between scientific institutions of the Latin American countries. Donald Nelson, who accompanied the party to Cuba, also conferred with President Batista.

The *Journal* reports that during the course of the negotiations, the University of Havana and the medical school of the university provided receptions by their faculties, and addresses were made by the American visitors and also by leading Cuban officials. Representatives of the Cuban Federation of Medicine also presented to the American delegation an offer of complete cooperation in the campaign for medical service in the war. The order of Carlos Finlay was conferred on the American visitors by President Batista.

A constitution and by-laws are being prepared for the conduct of the institute. Executive offices will be established both in Havana and in New York. The Cuban Government has agreed to provide \$20,000 annually for maintenance of the organization. Substantial contributions were made by several American industrialists and philanthropists.

THE GENETICS SOCIETY OF AMERICA

THE Genetics Society of America, at its annual business meeting held in Dallas, Texas, on December 30, announced the election of Professor E. W. Lindstrom as president for 1942 and Professor Marcus M. Rhoades as vice-president.

The members assembled at this meeting also adopted the following resolution:

WHEREAS, It is recognized that the growing burden of national defense makes it desirable and necessary for the Federal Government to practice utmost economy with regard to all non-essential expenditures; and

WHEREAS, The continuity of fundamental research, which now has been destroyed by war in almost all parts of the world, is probably the most important investment that can at present be made for the benefit of the post-war period; and

WHEREAS, It is to be hoped that the strength of the American form of government will be demonstrated by preserving the continuity of research work in this country;

Therefore, Be it resolved by the Genetics Society of

America to urge upon Congress and upon the Federal Government the importance of safeguarding the continued prosecution of fundamental research by those institutions which are now supported by federal funds; and

Be it resolved, further, that the secretary of the society be instructed to transmit this resolution to the Secretary of Agriculture, to the Secretary of the Association of Land-Grant Colleges and Universities, and to such other persons as may seem advisable.

THE WESTERN SOCIETY OF NATURALISTS

THE fourteenth annual winter meeting of the Western Society of Naturalists was held at Stanford University on December 29, 30 and 31. The sessions were attended by between seventy-five and a hundred members and guests. Three symposia were presented, as follows: "Determination, Differentiation, and Regulation in Animal Morphogenesis," *chairman*, Professor R. M. Eakin, University of California at Berkeley; "Some Western Highways of Learning," *chairman*, Dr. D. L. Fox, Scripps Institution of Oceanography of the University of California, La Jolla; "The Genetic Basis of Evolution," *chairman*, Professor H. L. Mason, University of California at Berkeley. Fifteen voluntary papers were presented.

On the evening of the first day at an informal reception and smoker, Dr. Ray Lyman Wilbur, president of Stanford University, gave a short address of welcome to members. President Wilbur's message was followed by a short skit by Professor Francis B. Sumner entitled "The Philosophical Basis of Pediatrics." Professor Arthur W. Meyer then presented some little-known chapters in the development of embryology at the time of von Baer, under the title, "A Notable Trilogy."

After the annual dinner on the following evening, the secretary read a short response in verse to Professor Sumner's notable address of the previous evening. Professor Gordon H. Ball, retiring president of the society, then delivered the address of the evening entitled "Parasitism and Evolution."

At the business meeting, the members voted to seek means of utilizing some of the funds in the treasury of the society for the purchase of U. S. Defense Bonds.

Officers elected for the year 1942 are as follows:

President: C. H. Danforth (Anatomy), Stanford University.

Vice-president: I. L. Wiggins (Botany), Stanford University.

Members-at-large: R. M. Eakin (Zoology), University of California at Berkeley; Carl Epling (Botany), University of California at Los Angeles.

THE PERIOD OF INTERNSHIPS IN NEW YORK CITY

DR. WILLARD C. RAPPEYE, commissioner of hos-

pitals of New York City, announces that in view of the urgent needs of the Army and Navy, the municipal hospitals of New York will modify their internships to a one-year period of training, in order to assist in the recruitment of medical officers for the armed services. The general plan contemplates that the basic internship shall be one year. Those who complete that service and are not eligible for a commission, because of physical defect or other reasons, may remain as residents either in the general services or on a special service. He stated that a certain number of residents will probably be permitted to continue their advanced training in special fields of medicine in order to insure a sufficient supply of specialists for the armed services and for civilian needs in the future.

The Department of Hospitals and its Advisory Council, comprising representatives of the medical boards of all the municipal institutions, are advising that all interns and residents eligible for military duty be urged to apply for a commission in the Medical Corps of the Army or the Naval Medical Corps Reserve. Under the existing rules of the Selective Service system, the local boards ordinarily will not defer interns beyond twelve months of hospital training. Residents and interns who do not apply for commissions will automatically come under the provisions of the Selective Service system and their cases will be disposed of in the usual manner by local boards.

Under the new program of the Procurement and Assignment Service, which is under the office of the Defense Health and Welfare Services in Washington, advisory committees to this Procurement and Assignment Service will be set up in each corps area of the United States. The function of these advisory committees is to assist in the recruitment of the medical personnel of the various Government services, and also to select these residents and others for advanced training in special fields or to help protect essential hospital services in the local communities. On these advisory committees to the corps area services are representatives of the hospitals, medical schools, the medical profession, dentists and veterinarians.

The department is asking that staff members of municipal hospitals be prepared to give more time and attention to their hospital work in order to insure adequate and proper care of the patients and to offset the growing shortage of interns and residents. It is expected that attending staff members who have recently been retired because of age, but who are still available for active duty, may be called upon to assist in this program.

AWARD OF THE COPLEY MEDAL OF THE ROYAL SOCIETY

THE Copley Medal of the Royal Society was

awarded to Sir Thomas Lewis at the anniversary meeting of the society held on December 1. In presenting the medal Sir Henry Dale said:

Lewis's life work, still in vigorous progress but for interruption by war duties and war conditions, has been the application of precise and controlled methods of experimental research to problems of clinical medicine. This has enabled him to achieve a detailed analysis of abnormalities of function produced by disease, injury or hereditary defect; and so far his attention has been centered upon the circulation of the blood and its disorders. Being attracted through the work of the late Sir James MacKenzie to the study of abnormal rhythms of the human heart-beat, Lewis recognized, about 1908, the great opportunity for a closer investigation of them offered by the then recent introduction of the string galvanometer by Einthoven. With its aid Lewis had soon made a number of clinical and laboratory studies, such as those in which he finally identified auricular fibrillation as the cause of a particular kind of complete irregularity. He was thus led to undertake, and to extend, with a succession of collaborators from many countries, the remarkable series of investigations, carried through in logical sequence between 1910 and 1923, in which he passed from the laboratory to the clinic and back again as the occasion demanded. It is fitting that special mention should here be made of the series of experimental studies published in our own *Philosophical Transactions* from 1914 to 1916, and presented in brilliant summary by Lewis in his Croonian Lecture to the society in 1917. In these were traced, with an astonishing precision of measurement and timing, the point of origin and exact course of the rhythmical waves of excitation and contraction in the normally beating heart of the dog, and, finally, for comparison, in the hearts of other classes of vertebrate animals. Considered by itself, this work ranks as one of the outstanding achievements of experimental physiology in our times, and it has given to physiology a large part of its

present detailed knowledge of the nature of the heart-beat. For Lewis, however, its greater importance lay in giving to clinical medicine the background for an accurate picture of disturbances of the normal mechanism, therewith a new security of diagnosis and prognosis in dealing with disordered actions of the heart, and ultimately a rational basis for their treatment. A new phase of cardiological thought and practice spread rapidly from Lewis's clinic round the world.

Meanwhile he had begun in 1917, and was to maintain with a series of collaborators for more than another decade, a separate series of investigations, dealing by direct experiment with the blood vessels of the human skin. Thus were elucidated the means by which the resistance of these vessels to the flow of blood is maintained and varied, including their complex reactions to chemical substances akin to histamine, which he proved to be released from the cells of the epidermis by injurious or irritant stimuli. These methods of investigation were later developed and extended to vascular disorders of the limbs, and the experiments of still more recent series have dealt with pain and functional defects in muscles and nerves, due to interruption of the blood supply. Apart from the separate accounts of items and stages of these lines of research, as completed, in papers which have issued from his department in steady sequence, Lewis has assembled and discussed the results, in their appropriate connections, in a succession of comprehensive monographs. He has been the inspiring leader of a group of younger workers in clinical research as an experimental science, has founded a society for such studies and has devoted to their use a journal which he had founded with a more limited scope.

The work of Thomas Lewis, which we honor to-day with the highest recognition in the gift of the Royal Society, is renewing and carrying forward, with a special directness, the great tradition which William Harvey created, before this society was founded.

SCIENTIFIC NOTES AND NEWS

EUGENE GIFFORD GRACE, president of the Bethlehem Steel Corporation, has been awarded the Bessemer Gold Medal for 1942 by the British Iron and Steel Institute.

MAJOR HARRY G. ARMSTRONG, in charge of research at the U. S. Army School of Aviation Medicine at Randolph Field, Texas, has been given the John Jeffries award of the Institute of the Aeronautical Sciences in recognition of his researches in the physiological and psychological effects of flying at high altitude and in high-speed maneuvers.

It is reported in *Nature* that the Symons Gold Medal for 1942 of the Royal Meteorological Society has been awarded to Dr. J. S. Owens, whose death occurred on December 6. This medal is awarded biennially for distinguished work in connection with

meteorological science. The presentation was made at the annual general meeting of the society on January 21.

DR. JULIAN C. MILLER, professor and head of the department of horticulture at the Louisiana State University, has been elected president of the American Horticultural Society.

ARTHUR F. VAN DYCK, manager of the industry service section of the RCA Laboratories, was inducted at the recent New York meeting on January 12 as president of the Institute of Radio Engineers. He succeeds Dr. Frederick Emmons Terman, professor of electrical engineering and head of the department at Stanford University.

ERNEST BATEMAN BLACK, consulting engineer of Kansas City, has been elected president of the Amer-

ican Society of Civil Engineers. Charles M. Spofford, of Boston, and Thomas E. Stanton, of Sacramento, Calif., have been elected vice-presidents.

JAMES G. McDONALD has resigned as president of the Brooklyn Institute of Arts and Sciences. Mr. McDonald, who is a member of the Board of Education and a partner in the firm of W. A. and A. M. White Company, stated that his resignation, which is to take effect on March 1, is due to the exigencies of the war. Adrian Van Sinderen, who has been first vice-president of the institute for many years, has been elected to succeed him.

THE Mathematical Association of America held meetings at Lehigh University on December 31 and January 1, in conjunction with the meetings of the American Mathematical Society, the Association for Symbolic Logic and the National Council of Teachers of Mathematics. On Thursday morning papers were presented by Professors Tibor Radó, C. R. Adams and N. H. McCoy, and on Thursday afternoon by Professors H. A. Rademacher, B. L. Newkirk and T. L. Smith. Professor Tomlinson Fort, of Lehigh University, was elected first vice-president, and Professors W. L. Ayres and R. L. Wilder were elected governors-at-large. Regional governors were chosen at the time of the meeting to represent seven of the fourteen regions into which the United States and Canada are divided.

DR. IRA L. BALDWIN, professor of agricultural bacteriology and assistant dean of the College of Agriculture of the University of Wisconsin, was reelected secretary of the Society of American Bacteriologists at the recent Baltimore meeting. He was, however, compelled to resign on account of ill health. He is succeeded as secretary by Dr. William B. Sarles, associate professor of agricultural bacteriology. The following resolution in honor of Dr. Baldwin was adopted by the society:

The Society of American Bacteriologists considers itself to have been honored by the devoted and distinguished services which Dr. Ira L. Baldwin has rendered as secretary-treasurer. It has profited and prospered under his careful and considered guidance. The influence of the society has grown immeasurably. Its membership has increased extraordinarily. These are not the results of simple chance. They stem from the devoted industry and sympathetic guidance of a faithful and beloved servant of our science. In complying with Dr. Baldwin's wishes, the society accepts his resignation from office with genuine reluctance and regret.

THE retirement is announced of Dr. Albert Galloway Keller, professor of the science of society at Yale University. A dinner was given in his honor on January 18 at which President Seymour was one of the speakers. Dr. Keller, who will reach the retiring

age of sixty-eight years in April, will take leave of absence until his formal retirement in June.

DR. GEORGE RUSSELL HARRISON, professor of physics and director of the research laboratory of experimental physics at the Massachusetts Institute of Technology, has been appointed dean of the School of Science. He will succeed Dr. Samuel C. Prescott, dean since 1931, who will retire on July 1.

DR. HOWARD E. FRITZ has been made director of research of the B. F. Goodrich Company, Akron, Ohio. Dr. Fritz, who has been connected with the company for the last seven years, succeeds James W. Schade, who has been director of research since 1925.

DEAN EDWARD STEIDLE, of the School of Mineral Industries of the Pennsylvania State College, left by airplane early in January for a visit to South America. He was appointed by Governor James as the representative from Pennsylvania to the first Pan American Congress of Mining Engineering and Geology, which was held at Santiago, Chile, from January 15 to 23. He was also a delegate from the American Institute of Mining and Metallurgical Engineers.

CAMILLE LHERISSON, professor of biology at the National School of Medicine, Port-au-Prince, Haiti, has arrived in Washington in response to an invitation of the U. S. Department of State to visit schools of medicine and departments of biology in the United States.

AT the New York convention of the Institute of Radio Engineers on January 12, 13 and 14, the principal address was made by Dr. F. B. Jewett, president of the Bell Telephone Laboratories and head of the communications division of the National Defense Research Committee. He spoke on "The Mobilization of Science." The medal of honor of the institute was presented to Dr. A. Hoyt Taylor, superintendent of the Radio Division of the Naval Research Laboratory.

PROFESSOR W. D. CAIRNS, of Oberlin College, gave two lectures on "The Mathematics of Seismology" before the graduate students of Brown University on January 5 and 6.

AUSTIN H. CLARK, curator of the division of echinoderms of the U. S. National Museum, delivered an address as retiring president of the Washington Academy of Sciences at the forty-fourth annual meeting of the academy. He spoke on "Science and War."

DR. H. E. McCOMB delivered on January 17 the address as retiring president of the Philosophical Society of Washington on "Geophysical Measurements in the Laboratory and Field."

THE London Times for December 11 prints the fol-

lowing statement: "Sir Patrick Hannon has given notice to ask the Minister of Information in the House of Commons if his attention has been called to the interview given by Professor Julian Huxley on his arrival in the United States of America to isolationist newspapers, in which he has expressed opinions tending seriously to affect the good relations between the United States of America and the British Commonwealth of Nations, and if he will take immediate steps for the recall of this lecturer."

ACCORDING to *Nature*, the Financial Secretary to the British Treasury stated on December 11 in reply to a question in the House of Commons that the number of students at universities and university colleges in Great Britain during the past autumn was approximately 25,000, of whom 5,900 were grouped as taking arts subjects and 19,100 scientific, technical and medical subjects.

At the autumn meeting of the National Academy of Sciences certain limitations were placed upon the use of the academy building in Washington, in order better to safeguard its defense activities. Since that meeting the United States has entered the war against the Axis powers, and the situation has changed. The executive committee of the council has made the following recommendations to the committee on arrangements for the 1942 annual meeting of the academy: that the meetings be restricted to members alone; that the scientific program be replaced by business meetings at which the functions and relations of the National Academy and of the National Research Council to our Government, during the emergency and afterwards, can be discussed confidentially and at length; that the organization of the academy be considered with reference to most effective operation during war time. Under the proposed arrangements, only members of the academy will be admitted to the sessions; no scientific papers will be read; no public lecture will be given; no formal dinner will be arranged; and no provision will be made for guests at any time, including the informal lunches and the smokers.

A MEETING of the Industrial Research Institute will be held in New York on February 6 and 7. Sixty industrial executives and research directors are expected to attend, and will participate in round-table discussions of research management. Headquarters will be at the Hotel Savoy-Plaza. The sessions will begin on Friday morning with a panel discussion of economic, political and social trends and their possible long-range effects on industrial research policies. There will be a dinner session on Friday evening. Dr. Sumner H. Slichter, professor of business economics, Harvard School of Business, will speak on "The Inter-

relationships of Labor Problems and Research Problems." On Saturday morning problems involved in adapting industrial research organizations and programs to war-time needs will be discussed.

THE Department of Economics of Columbia University has adopted the following paragraph for insertion in the announcement of the Faculty of Political Science. The department hopes that it will be brought to the attention of students interested in economics at a sufficiently early stage to lead them to acquire at least the mathematical preparation indicated while they are still undergraduates. This is not a requirement, but is advice offered to prospective graduate students in economics; and also that some economic studies make use of mathematics substantially more advanced than calculus and higher algebra. "*Mathematical Preparation*: The use of mathematics, including higher mathematics, has become important in several branches of economics and statistics. Much of the recent important literature of general economics is written in a language not easily understood without some knowledge of the differential and integral calculus. Students planning to work for the Ph.D. degree in economics will therefore find it advantageous to acquire familiarity with the calculus and with higher algebra before beginning their graduate studies in economics."

FOLLOWING a proposal of the Iowa State College Chapter of the American Association of University Professors, the college is instituting a series of "Honor Lectures," to be delivered by members of the staff and published by the Iowa State College Press. The series is designed to examine and emphasize the social philosophy and human significance of science and technology; to provide regular opportunities for the members of the faculty and the graduate student body to learn of recent advances in fields of scholarship other than their own, and to recognize and encourage quality and distinction in teaching and research among the members of the staff. The lecturers will be chosen by a committee of officials of the college, of the chapter of the American Association of University Professors and of other professional societies.

ACCORDING to a cable from Bogota, Colombia, to the *New York Times*, an Institute of Tropical Agriculture is to be established in Colombia to foster the development of the natural resources and productive capacity of the country. Under the agreement by the Colombian Government and the U. S. Department of Agriculture, \$5,000,000 is to be allotted to the work.

DISCUSSION

NATURE OF GROUP THEORY

For thousands of years the operations of addition and multiplication of ordinary numbers have commonly been regarded as two distinct operations but in group theory, with the exception of zero in multiplication, they are regarded as belonging to the same more general operation. This is due to the fact that in group theory we restrict our attention to what is common to these two operations. In the first place, both of them relate to the combination of elements so as to obtain a single element of the same kind, and the resulting element is independent of how these elements are associated before they are combined. That is, in both of these operations the associative law of combination is satisfied. In fact, the commutative law of combination is also satisfied in both of them but for the sake of greater generality and a comparatively small loss in simplicity this law is not assumed as fundamental in group theory and an essential part thereof.

In 1870 L. Kronecker (1823-1891) read a paper before the Berlin Academy of Sciences in which he remarked that the extremely simple principles upon which Gauss's method is based occur not only at the place to which he had referred but also at many other places and they are used already in the most elementary parts of number theory. This circumstance points to the fact, which can readily be verified, that these principles belong to a sphere of more general and more abstract ideas. Hence it seems desirable to develop them independently of all unrelated matters so that a repetition of the same arguments in their use on different occasions may be avoided. The resulting advantages appear already in the developments themselves, and the presentation thus gains in simplicity and perspicuity by the restriction to what is essential.

These observations were followed by a system of postulates for what is now commonly called an abstract abelian group, but the term group was not then used by him. They illustrate the fact that group theory is not only a subject of mathematics but also an isolation of ideas which are fundamental in various mathematical subjects and a development of these ideas with a view to avoiding repetitions when they present themselves in different subjects. It therefore contributes to the economy of thought and as it relates also to the most elementary subjects of mathematics it may reasonably be expected to be permanently useful. This may account for the recent group theory week at what was then a leading mathematics center of Europe, Göttingen, Germany, and was reported in *Crelle's Journal*, volume 182, pages 129-248 (1940).

The fact which we aim to emphasize here is that abstract group theory was developed before the postulates on which it is based were explicitly formulated so that these postulates resulted from observing basic facts underlying these developments. It is true that after this formulation these developments were greatly extended and gave rise to an autonomous subject of considerable extent which differs widely from the subjects which gave rise to it. Just as the operations of addition and multiplication will probably always be regarded as distinct operations, notwithstanding their union in group theory, so in other fields where the group theory point of view led to interesting broader points of view the original methods have not always become obsolete as a result of these broader views.

Since the term "group" was used in the non-mathematical literature long before it was adopted by the mathematicians as a technical term and its use as such a term grew unusually rapidly in recent years on account of its wide applications, it may not be surprising to find that it is still often misused, especially by popular writers. Some of our best and most recent dictionaries of the English language still fail to give a definition of this term which is in accord with those commonly employed in the modern treatises on the subject. In particular, the associative law is often omitted in the definitions found in these dictionaries. This makes it more desirable to emphasize the nature of group theory as a scientific subject of growing importance, especially in view of the numerous recent misstatements relating thereto by men in positions of great influence.

G. A. MILLER

UNIVERSITY OF ILLINOIS

THE STATUS OF EXPERIMENTAL PSYCHOLOGY AMONG THE LABORATORY SCIENCES

In order to determine to what extent experimental psychology is being recognized as a laboratory science that will satisfy laboratory requirements toward the A.B. degree, the following questionnaire was sent to 75 of our leading universities and colleges:

1. Does your College of Arts and Science require a minimum number of hours of laboratory science as a prerequisite to the A.B. degree?
2. Is the course in Experimental Psychology recognized as a laboratory science that will satisfy the above prerequisite for a degree?

The replies to this questionnaire indicate three distinct trends in the status of experimental psychology.¹

The first trend is represented by those institutions that require a laboratory science for the A.B. degree, and that recognize experimental psychology among

¹ Data obtained in 1937.

the laboratory sciences that satisfy the requirement. This group includes the following:

Clark University	University of Georgia
College of the City of Detroit	University of Idaho
Columbia University	University of Illinois
Indiana University	University of Minnesota
Johns Hopkins University	University of North Carolina
Leland Stanford University	University of Pennsylvania
Ohio University	University of Pittsburgh
Oregon State University	University of South Carolina
State University of New Mexico	West Virginia University

The second trend is represented by those institutions that require a certain amount of laboratory science but do not permit experimental psychology to satisfy this requirement. This group includes the following:

Carnegie Institute of Technology	University of California (Berkeley)
College of the City of New York	University of California (L.A.)
Cornell University	University of Chicago
Duke University	University of Cincinnati
Emory University	University of Colorado
George Peabody College	University of Delaware
Georgetown University	University of Florida
George Washington University (D. C.)	University of Kansas
Montana State University	University of Maryland
New York University	University of Missouri
North Dakota University	University of Nebraska
Northwestern University	University of New Hampshire
Ohio State University	University of Oklahoma
Princeton University	University of South Dakota
Rutgers College	University of Tennessee
State University of Nevada	University of Texas
Syracuse University	University of Vermont
Toledo University	University of Virginia
Tulane University of Louisiana	University of Wisconsin
University of Alabama	Vanderbilt University
University of Arizona	Washington University
University of Arkansas	Western Reserve University

The third trend is represented by those institutions that do not require any laboratory work for the A.B. degree. This group includes the following:

Brown University	University of Maine
Duquesne University	University of Michigan
Harvard University	University of Mississippi
Louisiana State University	University of Washington
University of Buffalo	University of Wyoming
University of Kentucky	Yale University
University of Louisville	

Summarizing the results of the questionnaire, we gather the following:

62 of the 75 institutions (82 per cent.) require a laboratory science for the A.B. degree.

18 of the institutions (29 per cent.) requiring a laboratory science include experimental psychology among the sciences that will satisfy this prerequisite for a degree.

13 institutions (17 per cent.) do not require any laboratory science for the A.B. degree.

44 institutions (58 per cent.) do not at present permit experimental psychology to satisfy the laboratory requirement for the A.B. degree.

JOHN E. WINTER

WEST VIRGINIA UNIVERSITY

A PLIOCENE WATERHOLE IN WESTERN KANSAS

THIS fall our attention was called to the occurrence of mammal tracks in "Cretaceous chalk" in Graham County, Kansas. Investigation showed an interesting set of footprints which had been exposed by a washout of the spillway from a pasture pond. A thickness of fifteen to twenty feet of sand capped with soil had been washed away, exposing the bedrock with the tracks.

We have found an abundance of the tracks, including camel, rhinoceros, mastodon, one large carnivore track and a number of small tracks as yet unidentified. In places the tracks literally cover considerable areas of the rock.

The matrix enclosing the tracks is a yellowish chalky marl. It grades vertically into less marly chalk of Niobrara Cretaceous. In this, about five feet below the track horizon, one of the boys on the ranch had found fragments of a Cretaceous fish of the genus *Empo*. The rock is covered by a thick layer of almost unconsolidated sand which contains almost no pebbles. In the rock enclosing the tracks and apparently tramped into some of the tracks scattered hard-rock pebbles such as we find abundantly in the "mortar beds" are found. In the over-lying sand the rancher had found a fossil turtle, *Testudo orthopygia*.

The track assemblage indicates a Pliocene age. The rock is a Cretaceous chalk which had been exposed in Pliocene times and had been reworked under water with clay into a marl. The old water-hole floored with this marl preserved a sample of the tracks of at least a few of the types of mammals of that period.

Further study of the tracks and of the rock are being made and will be described at a later date.

GEORGE F. STERNBERG

GEORGE M. ROBERTSON

FORT HAYS KANSAS STATE COLLEGE,
HAYS, KANSAS

THE CASE OF DR. S. LEVINE

JUST to-day I have had an opportunity of reading the article "War Hysteria in Canada," page 461 of *SCIENCE*, November 14, 1941, and I desire to make a few comments.

At the outset I wish to deprecate very strongly the title of the article. If you were more intimately acquainted with Canadians you would probably realize that they are not given to hysteria.

With regard to the unfortunate experiences of Dr. Levine I may say that his case should be divided into two incidents, namely:

1. His trial, conviction, after an appeal, and his imprisonment on the charge "possession of documents intended or likely to cause disaffection to His Majesty."

2. His internment after release from prison.

Regarding his trial I have followed this case rather closely and have had access to the evidence given in court, and I have no hesitation in saying that, to my mind, there is positively no foundation for the suggestion which appears in this article that there was a "miscarriage of justice." Neither is there anything in the veiled suggestion that Dr. Levine suffered through not having the opportunity of trial by jury. I have just spoken to Dr. Levine's personal lawyer and he informs me that Dr. Levine was not discriminated against in any way as to trial by jury.

Regarding the second item, Dr. Levine's internment, the evidence in the hands of the police, upon which anybody is interned, is not made public. As a matter of routine Dr. Levine's case was reviewed by a commission dealing with several such cases; as a result of the recommendation of this commission Dr. Levine has been recently released.

In the article reference has been made to the evidence of myself and some of my colleagues who appeared on Dr. Levine's behalf at his appeal trial and before the internment commission. As far as I am concerned personally, and I think I may speak for the others, my evidence was in the nature of character evidence and an appraisal of Dr. Levine's academic attainments, together with the suggestion that Dr. Levine would not be dangerous if released. As to the actual facts of the case we were all quite ignorant.

I should also like to make public the position that Dr. Levine occupied at the time of his arrest. After graduating from the University of Toronto B.A. (1932), M.A. (1933), he had held fellowships in different universities in the United States and spent the academic years of 1937-1938 and 1938-1939 at the University of Cambridge, England. During all this time he was pursuing a problem which I first suggested to him the year he graduated at the University of Toronto.

Early in July, 1939, I had letters from two of his Cambridge professors asking me if I could provide for Dr. Levine for the year 1939-1940. In view of the disturbed state just before the war broke out it was realized that the work on which Dr. Levine was engaged could not be continued there. I had to reply that I had no money available to employ Dr. Levine but that I would keep him in mind. Some time in

August of that year there came to me from a private donor an offer of \$1,500 to pay the salary of a mathematical physicist to undertake some work in the field of geophysics. Although this was not the particular field in which Dr. Levine's work lay, up to that time, I was confident that he would be able to carry out the new work in geophysics and consequently offered to take him on for the year 1939-1940. He began this work about November 1st, 1939. In order that he might be added technically to the Department of Physics, he was given the title of Fellow in Geophysics, but his remuneration did not at any time come from the regular budget of the university. The actual problem on which he was working was completed before his arrest. As he had not completed the full year (12 months) for which the money was provided his employment was continued into the academic year 1940-1941.

It came to me as a bolt from the blue when he was arrested in September, 1940, on the above charge. There is a complete misunderstanding in the suggestion in your article that he has been discharged from the staff of the Department of Physics of the University of Toronto. You will easily understand that his arrest greatly dampened the generosity of the private donor who was providing for his upkeep. As a matter of fact Dr. Levine was paid his salary up to the end of October, 1940—that is, he received the full amount (\$1,500.00) donated for a full year's work, although he was arrested early in September.

There is only one other point that I wish to mention. A great deal is made in some of the articles written about this case that Dr. Levine's work in mathematical physics "contributes significantly to the success of the Canadian war effort in the international fight against Fascism." When I appeared on behalf of Dr. Levine when his appeal was being heard I was asked if his work was important for the war effort and my answer was that it might be looked upon as important only so far as all work in geophysics might enable us to discover new materials likely to be useful in the present war. An account of this work has been published in the scientific magazine, *Geophysics*, 6, April, 1941, page 180.

As a matter of fact Dr. Levine has no more moral claim on the University of Toronto than any other of the university's hundreds of graduates. The total number on the staff now working in the Department of Physics is seventy-six, practically all university graduates: of these only nineteen could be considered as having any claim to employment after the current year. Dr. Levine did not at any time belong to the permanent classification.

E. F. BURTON,
Director, McLennan Laboratory

SCIENTIFIC BOOKS

MEDICAL GENETICS

Medical Genetics. By L. H. SNYDER. Durham, N. C.: Duke University Press, 130 pp. 1941. \$1.50.

A BIOLOGIST trained in the Harvard School of Genetics, incumbent of the first chair of medical genetics in the land and chairman of the committee of human heredity of the National Research Council has given to the public the lectures that he delivered to the entire body of medical students of Duke University, Wake Forest College and the University of North Carolina with aid from a grant of the Carnegie Corporation. This is well, for as Dr. William C. Davison, of Duke University, says in the foreword, "the knowledge of medical genetics is of practical value in the diagnosis and prognosis of disease and in the everyday practice of medicine."

The book comprises 10 chapters, bibliography and index, and is illustrated. The first chapters consider "The Study of Human Heredity" and "Medico-legal Applications" for which the author is especially prepared by his books, "Principles of Heredity" and "Blood Grouping in Clinical and Legal Medicine." The remaining chapters deal each with inheritance of defects found in a particular group of organs, with susceptibilities and with cancer. At the outset difficulties in the study of human genetics due to small size of families, great length of the generation and varied types of genic behavior and genic expression are referred to; and certain misconceptions regarding geneticists and genetics are listed, such as that geneticists believe that all characters are rigidly determined by heredity, that a character conditioned by heredity can not be altered by environment, that the discovery of a genetical factor for a condition renders further research in that condition futile, that if a causative agent for a disease is discovered heredity factors are excluded, that absence of knowledge of action of the hereditary factor makes "heredity" meaningless. "These are all false."

The body of the text gives examples of what is definitely known about the heredity of certain traits, and here it becomes clear that less is known about certain groups of traits than about others. Thus the genetic basis of abnormalities of the skin, eyes, skeleton and muscles have been satisfactorily worked out in a large number of cases. And this is partly because they are readily observable and diagnosable, so that the family history of the abnormality is fairly complete. On the other hand, the inheritance of mental disorders and diseases of the blood is less fully known.

The book helps open a new era in the study of human genetics by popularizing the recognition of the varied types of heredity transmission—dominant, recessive and blending—as well as the varied relations and behavior of genes, such as autosomal, sex-linked, sex-influenced, lethal, epistatic and combined genes, as seen in multiple alleles and multiple factors. "No longer does the familiar 3:1 ratio cover the major portion of the field of heredity." The difficulty of classifying any particular heredity as dominant or recessive is increased by the fact of degrees of dominance. Thus there are degrees of *penetrance* of the dominant gene such that the proportion of affected individuals in a fraternity or generation may depart from expectation. The author recognizes that the differentiation between a dominant gene with low penetrance and a recessive gene is not easy and requires large and unbiased samples and special analytic treatment of them. Again there may be degrees of *expressivity* or degrees of development of the dominant trait even when only a single gene is involved. For example, hemolytic icterus (blood-destroying jaundice) may show symptoms ranging from jaundice and chronic anemia to newly regenerated red blood cells and somewhat enlarged spleen. Again, Von Recklinghausen's disease or neurofibromatosis has a variable expressivity, appearing as cafe-au-lait spots, subcutaneous tumors and plexiform neuroma. This variation in expressivity may be due to environment (*e.g.*, vitamins); but probably constitutional factors play a part perhaps by the varying of the activity of hormones.

Despite all difficulties attempts must be made, and are being made, to work out linkage groups in man's 24 chromosomes. Apart from sex-linked groups little progress has been made. The greatest advance has been secured in the field of "incomplete sex-linkage." To this and results obtained by the new technique Snyder devotes the last and most timely chapter, which constitutes the clearest and fullest statement extant of progress in this field.

While the book is, in general, beyond criticism two points occur to the reviewer as not sufficiently emphasized. One point is that modern pathology seems to be far from appreciating the fact that its categories of disease and defect are shown by genetical studies to be far from unitary. Conditions that are considered under the same name have diverse constitutional organic bases. For example, retinitis pigmentosa and microphthalmus are recessive in some families, dominant in others and sex-linked in still others. Myopia may have either recessive or dominant basis. Of can-

cers some are stated to depend on dominant, others on recessive factors, and others are affected by multiple or modifying factors.

Finally a point which is not wholly overlooked in this book is, however, insufficiently stressed. It is that those traits that have a known chemical basis have the clearest cut genetics. One of the best illustrations of this conclusion is the blood groups with their agglutinogens and agglutinins. Others are found in the group of the feeble-minded—some types of which are associated with phenylpyruvic acid excretions (recessive trait), some with thyroid deficiency, like cretinism and others with storage of phosphatides like amaurotic family idiocy (a recessive). There is quite an array of inherited errors of metabolism which Garrod emphasized over 30 years ago. Again there is the dopa reaction upon which pigmentation of skin, hair and retina depend. If two or more pairs of genes are actively accelerating melanin formation in the skin the full Negro pigmentation is produced.

The relation between the somatic expression of a trait and its chemical basis may be remote. Thus hardness of hearing seems to depend on a defect in calcium metabolism such as causes abnormal bone for-

mation at the oval window of the inner ear and simultaneously in other parts of the temporal bone. In this latter case there is reason for concluding that the result depends on a dominant factor in an autosome which modifies the reaction of the mesenchyme and a sex-linked gene which perhaps affects calcium metabolism. Indeed it seems probable that in time chemical errors in the body may throw light upon the chemical processes of development.

The fact that so many mutations have a known chemical basis and that development is, indeed, a biochemical process raises the question whether all mutations have not and lead us to seek the chemical basis of any defect. As the chemical bases of mutations are discovered the mutations may well be classified as a chemical basis rather than a morphological. Thus defects in pigmentation might well be grouped together instead of being distributed like albinism under "the eye" and skin color under "the skin." However, we are at present far from knowing these biochemical bases, with minor exceptions, and so for the present the morphological classification employed in part by the author is excusable.

CHAS. B. DAVENPORT

REPORTS

ANNUAL REVIEW OF ACTIVITIES AT FIELD MUSEUM FOR 1941

EXPANSION and improvement of exhibits continued during 1941, as for some years past, to be the major activity of Field Museum of Natural History. Two entirely new halls, one in the department of zoology and one jointly installed by the departments of anthropology and geology, were opened, and many additions were made to the exhibits in other halls throughout all departments.

The year was noteworthy also for an attendance in excess of 1,350,000 visitors; for the continuation of collecting and research by expeditions dispatched to various fields in North, Central and South America, and for the publication on a large scale of the results of these expeditions and other scientific research activities conducted by the staff of the museum.

One of the new exhibition halls is the large new Hall of Fishes, containing elaborate undersea habitat groups, and an extensive series illustrating relationships of the different species. The groups include underwater scenes of the Bahama Islands, the Texas Coast and the shores of Maine. The hall was prepared under the supervision of Alfred C. Weed, curator of fishes; the hundreds of reproductions of fishes were predominantly the work of Staff Taxidermist Leon L. Pray, although other taxidermists and artists also contributed.

The second new hall was H. N. Higinbotham Hall of Gems and Jewels, in which the museum's comprehensive collection of precious stones was reinstalled in a manner that brings out their full beauty of color, luster and brilliance as never before. The most modern museum techniques and equipment were employed, including new types of exhibition cases and improved fluorescent lighting methods.

A unique exhibit was installed in the Hall of Egyptian Archaeology through the courtesy of the General Electric X-Ray Corporation of Chicago, which contributed the x-ray and mechanical equipment. In this exhibit a mummy in its wrappings is shown alternately with the revelation of its skeleton on a fluorescent screen. Among many other additions and improvements to the exhibits are included a habitat group showing the inter-tidal algal vegetation of the rocky north Atlantic shore.

Further investigations were made of the prehistoric Mogollon Indian culture in New Mexico by the Field Museum Archeological Expedition to the Southwest. Dr. Paul S. Martin, chief curator of anthropology and leader of the expedition, with associated archeologists, and a "labor force" of twelve for the actual digging, excavated the ruins of an ancient village which had been occupied sometime between 1,200 and 2,400 years ago.

Notable additions to the museum's zoological col-

lections were made by the Leon Mandel Galapagos Expedition. Scientific personnel included Dr. Wilfred H. Osgood, curator of zoology emeritus; Rudyard Boulton, curator of birds; Loren P. Woods, assistant curator of fishes; Staff Taxidermist Leon L. Walters, and Melvin Traylor, associate in ornithology. Colin C. Sanborn, curator of mammals, sailed to undertake collecting and studies of Peruvian animals.

An expedition which has as one of its objects the determination of the date at which the Isthmus of Panama emerged from the sea was dispatched to Central America in November and will continue its work in 1942. Paul O. McGrew, assistant curator of paleontology, is in charge.

Dr. Sharat K. Roy, curator of geology, collected invertebrate fossils in New York State. Llewelyn Williams, curator of economic botany, sailed in October for a botanical expedition in Venezuela, and will continue collecting and researches for about a year. Donald Collier, assistant curator of ethnology, left in September for five months of archeological research in Ecuador. Dr. Francis Drouet, curator of cryptogamic botany, made an extensive collection of the cryptogamic plants of California. Dr. Fritz Haas, curator of lower invertebrates, collected thousands of representative Pacific shore animals in southern California. A botanical expedition to Guatemala, which began work in 1940, was concluded by Paul C. Standley, curator of the herbarium, and followed by a new expedition to the same country conducted by Dr. Julian A. Steyermark, assistant curator. Emmet R. Blake, assistant curator of birds, and Melvin A. Traylor, Jr., associate in ornithology, carried out a successful ornithological expedition in the southwest. Several specimens of one of the earliest large mammals to walk the earth, the rare *Coryphodon*, and many other fossil animals were collected by a paleontological expedition to the West under Bryan Patterson, assistant curator of paleontology. Mr. Patterson was assisted by James H. Quinn, and others. An important mineral collection was assembled by Bryant Mather, assistant curator of mineralogy, in various eastern states; mammals of the Mount Tancitaro area were collected by Frank C. Wonder on an expedition to Mexico; Mexican insects were obtained by Henry Dybas on a field trip to the Cordoba and Vera Cruz

regions; and fossil remains of a ground sloth of the genus *Megalonyx* were collected near London Mills, Illinois, by Assistant Curator Patterson.

Besides the approximately 1,350,000 persons who visited the museum, many additional hundreds of thousands benefited from activities conducted outside of the institution's own building, such as the illustrated lectures and other programs presented by the James Nelson and Anna Louise Raymond Foundation, and the traveling exhibits circulated in the schools by the N. W. Harris Extension.

On May 2, 1941, Field Museum celebrated the twentieth anniversary of its occupation of the present building in Grant Park. Since 1921, more than 25,000,000 persons have entered this structure. More than 5,800,000 others visited the museum during some twenty-five years in its old location in Jackson Park.

For the first time in the history of such institutions as museums in this country, a federal tax on admission charges became effective on October 1. This tax, amounting to three cents each on paid admissions, is now charged to adults, but in the case of children, students, teachers and others to whom the museum is of direct educational importance, the museum itself is paying the cost in order that full benefits to children and to the schools may not be curtailed.

The library of the museum continued to add to its extensive collections of scientific books, which now number approximately 124,000 volumes. A new modernized reading room was prepared for the service of the public.

Boardman Conover and Howard W. Fenton were elected to fill vacancies on the board of trustees. Trustee Albert W. Harris resigned for personal reasons. Two trustees, Brigadier-General Theodore Roosevelt and Ensign Joseph Nash Field, were called to active service in the U. S. armed services. A number of other members of the museum personnel were likewise called into various branches of military service and the museum will hold their positions open for them when they return. Among new appointments to the museum staff were Orr Goodson, assistant to the director; Donald Collier, assistant curator of ethnology; Melvin A. Traylor, Jr., associate in ornithology; Elizabeth Best, guide-lecturer in the Raymond Foundation; and John Janecek, illustrator.

CLIFFORD C. GREGG

SPECIAL ARTICLES

"PEPSITENSIN"—A HYPERTENSINLIKE SUBSTANCE PRODUCED BY PEPTIC DIGESTION OF PROTEINS

CERTAIN findings suggest that the vasoconstrictor

and hypertensive substance which originates under the influence of renin is a polypeptid.¹ We were able

¹ J. M. Muñoz, E. Braun-Menendez, J. C. Fasciolo and L. F. Leloir, *Am. Jour. Med. Sci.*, 200: 608, 1940.

to show that a vasoconstrictor and hypertensive substance can be produced not only by incubation with renin but also by peptic digestion of hypertensinogen.

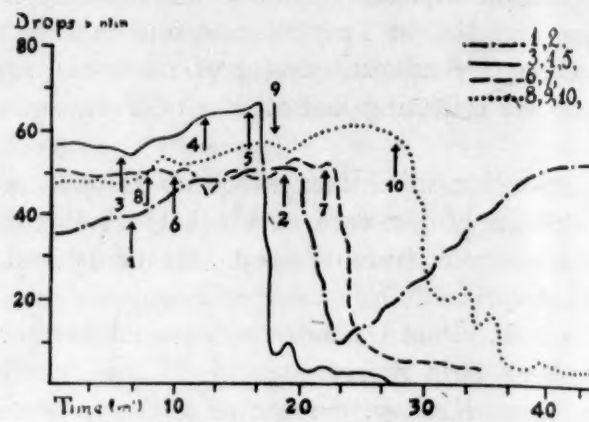
0.5 cc of a standard preparation of hypertensinogen² or renin activator³ in hydrochloric acid (pH = 2 to 6) were incubated at 38° for 15 min. with 1 to 2 mgr of commercial or purified pepsin (Merck) in 0.1 cc of dest. water. A buffer solution of m/5 phosphate of pH = 7.2 was added. A vasoconstrictor effect of great intensity was observed in the Laewen-Trendelenburg preparation of the giant Chilean frog *Calyptocephalus Gayi*. We obtained also in cats a very remarkable rise of arterial pressure with hypertensinogen incubated with pepsin and conveniently concentrated and purified.⁴

Subsequently we were successful in obtaining a vasoconstrictor substance from different proteins (casein, fibrin, serumalbumin and ovalbumin) incubated with pepsin under conditions identical with those described above for hypertensinogen. The vasoconstrictor effect was always noticeable, though less than with pepsin-incubated hypertensinogen or with hypertensinogen incubated with renin (Fig. 1).

The physiological and chemical properties of the vasoconstrictor substance produced by incubation of proteins with pepsin also resemble those of hypertensin as described by Houssay: the substance is thermostable, soluble in water and strong alcoholic solutions, insoluble in ether, it dialyzes easily through the Cellophane membrane, it is precipitated by phosphotungstic but not by trichloroacetic acid. Trypsin destroys the vasoconstrictor substance produced by pepsin in a similar way as hypertensin is destroyed. Our substance behaved towards hypertensinase¹ also in a way similar to hypertensin: the substance was, like hypertensin, inactivated when mixed with renal extracts (from pig, human, rat) at a neutral pH.

It has been shown by Schroeder⁵ with angiotonin (Page) and by our former work⁶ with hypertensin that these substances are inactivated by tyrosinase of mushrooms. Likewise we found recently that the vasoconstrictor substance as derived from proteins is destroyed by tyrosinase. This is in favor of the assumption that hypertensin has a phenolic function. Other new findings of ours also are in full agreement

with this assumption. Whereas so many proteins when incubated with pepsin generated the vasoconstrictor substance the latter failed to appear when *gelatin* was subjected to incubation with pepsin.



EXPLANATION OF FIGURE

Perfusion of Laewen-Trendelenburg preparation of the giant Chilean frog with Ringer. Ordinates—number of drops per minute. Abscissa—time in minutes. Arrow indicates addition of different solutions. 1. Solution of casein (Hammersten, 3%) for 30 min. in HCl (pH = 5.5); no vasoconstrictor action. 2. Same but incubated with pepsin (Merck-Payr); vasoconstrictor action. 3. Hypertensinogen in HCl; no action. 4. Solution of pepsin (Merck-Payr); no action. 5. Hypertensinogen incubated with pepsin (pH = 4.5); vasoconstrictor action highly pronounced and more stable than in 2 (pepsin-casein). 6. Pepsin in HCl; no action. 7. Hypertensinogen incubated with pepsin (pH = 6); highly pronounced vasoconstriction. 8. Purified gelatin (5%) incubated with pepsin; no action. 9. Same but double quantity added; no action. 10. Hypertensinogen incubated with renin; pronounced vasoconstrictor action.

Conclusions: A substance similar to hypertensin as to physiological, physical and chemical properties can be derived from hypertensinogen by incubation with pepsin. This substance is probably a polypeptid with a phenolic function and it is very likely that this applies also to hypertensin. The term "pepsitensin" seems appropriate for the new substance.

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IN VITRO CULTIVATION OF THE STREET VIRUS OF RABIES

SUCCESSFUL *in vitro* cultivation of the virus of rabies has been reported by Kanazawa (1936 and 1937)^{1,2} employing a medium consisting of rabbit embryo brain tissue suspended in Tyrode solution,

¹ Kanazawa, *Jap. Jour. Exp. Med.*, 14: 519, 1936.

² Kanazawa, *Jap. Jour. Exp. Med.*, 15: 17, 1937.

² E. Braun-Menendez, J. C. Fasciolo, L. F. Leloir and J. M. Muñoz, *Soc. Argent. Biol.*, 15: 420, 1939.

³ K. G. Kohlstaedt, I. H. Page and O. M. Helmer, *Am. Heart Jour.*, 18: 618, 1939.

⁴ The method of purification was used as described by Braun-Menendez for hypertensinogen incubated with renin. E. Braun-Menendez, J. C. Fasciolo, L. F. Leloir and J. M. Muñoz, *Jour. of Physiol.*, 98: 283, 1940.

⁵ H. Schroeder and N. Adams, *Jour. of Exp. Med.*, 73: 531, 1941.

⁶ H. Croxatto and R. Croxatto, *Proc. Soc. Exp. Biol. and Med.*, 48: 392, 1941.

without serum; by Webster and Clow (1936 and 1937)^{3,4} in a medium consisting of mouse and chick embryo brain tissue suspended in serum Tyrode; and by Schultz and Williams,⁵ who confirmed the latter's work. Kanazawa and Schultz and Williams employed a fixed rabbit strain while Webster and Clow employed three strains originating as follows: one strain from a skunk which was passed through six mouse brain passages, and two dog brain strains passed through eighty-eight and eight mouse brain passages respectively before initiating cultures. Direct *in vitro* cultivation of the street virus of rabies has not been reported.

The source of our infectious material was obtained as follows: About three months after a young man was bitten by a stray dog on the ring finger of his left hand, he developed symptoms of rabies and died in a typical attack. Examination of the brain showed Negri bodies. The brain was preserved in 50 per cent. glycerine. (This will be designated as strain A.)

The second strain was obtained from a rabid dog which was killed after paralysis developed. Examination of this brain showed Negri bodies. The brain was preserved in 50 per cent. glycerine. (This will be designated as strain B.)

Each brain specimen was treated as follows: Several pieces of brain were washed four times in Ringer's solution to remove the glycerine and then the material was ground in a mortar with alundum. A 10 per cent. aqueous suspension was made and centrifuged at 1,200 r.p.m. for ten minutes. The supernatant fluid was titrated for infectivity by inoculating serial dilutions—0.03 cc intracerebrally—into mice, and the rest of the supernatant fluid was employed for culture. The infectivity of strain A was 10^{-3} , killing mice after 14 days and Negri bodies were demonstrated in the brain (Sellard's stain).

Strain B was infectious in a dilution of 10^{-2} , killing mice in 9 to 12 days, with the presence of Negri bodies in the brain.

The medium employed for culture was essentially the same as has previously been described^{6,7,8,9} for the cultivation of the virus of fowl plague, vaccinia and measles. Three cc of Tyrode solution and 0.5 cc of unfiltered monkey serum was placed in a 50 cc Erlenmeyer flask. To this was added four drops of a ten-day chick embryo cell suspension prepared with the Fisher press, and 1 cc of virus material and three drops of chicken plasma. The contents of the flask

were gently shaken and stoppered with a rubber stopper. Cultures were maintained at 37° C. for three to four days.

After twenty-four hours the plasma clot was found floating on the surface of the liquid medium. Sections made of the clot show proliferating cells, in contrast to the non-proliferating cells which exist in a suspended cell medium. One of us^{6,7} had previously shown that the virus of fowl plague and the virus of vaccinia grow much better in the presence of proliferating cells than they do in the presence of suspended cells. The experiments of Feller, Enders and Weller¹⁰ bear on this observation.

Transplants are made by grinding the entire culture in a grinder with alundum and transferring 1 cc of the supernatant material to a new flask of media. Strain A was maintained through eleven transplants while Strain B was maintained through nine transplants.

During the course of these experiments, various transplants were inoculated intracerebrally into mice to determine the presence of virus. With strain A, mice died in from seven to eleven days, showing the presence of Negri bodies in the brain. The brain of a mouse that died after the inoculation with the eighth transplant (strain A) was titrated for infectivity. A dilution of 10^{-5} killed mice in eight days and the brains were Negri positive.

Titration of the clot of the eleventh transplant (strain A) killed mice in a dilution of 10^{-6} in eight and eleven days, but no Negri bodies were found. In a dilution of 10^{-5} , mice died in nine and eleven days and Negri bodies were demonstrated in the brains. The mice that died after inoculation with the lower dilutions were also Negri positive.

Titration of the clot of strain B killed mice in twelve days in a dilution of 10^{-5} and the brains were Negri positive. Other mice inoculated with this dilution showed tremors on the thirteenth day and Negri bodies were demonstrated in the brain. Mice inoculated with lower dilutions, that died or were sacrificed when tremors were present, also showed Negri bodies in the brain. While strain B was infectious for mice in a dilution of 10^{-5} , this strain was not as virulent for mice as strain A.

We failed to cultivate the virus from another dog brain.

The street virus of rabies has been cultivated directly from the brain of a human case of rabies as well as from the brain of a rabid dog. The virus has been successfully cultivated through eleven and nine transplants respectively. The method of culture employed consists of whole chick embryo tissue instead of embryo brain tissue alone, as has hitherto been

¹⁰ Feller, Enders and Weller, *Jour. Exp. Med.*, 72: 367, 1940.

³ Webster and Clow, *SCIENCE*, 84: 487, 1936.

⁴ Webster and Clow, *Jour. Exp. Med.*, 66: 125, 1937.

⁵ Schultz and Williams, *Proc. Soc. Exp. Biol. and Med.*, 37: 372, 1937.

⁶ Plotz, *C. R. Soc. Biol.*, 125: 603, 1937.

⁷ Plotz, *C. R. Soc. Biol.*, 125: 719, 1937.

⁸ Plotz, *Bull. Acad. de Méd., Paris*, 119: 598, 1938.

⁹ Plotz, Third International Congress of Microbiology, Report of Proceedings, p. 358, 1940.

used. The "floating clot" method has the advantage of providing a large mass of proliferating cells, which provide a great yield of virus. In view of this, experiments are being performed to determine whether these cultures can be employed as a vaccine.

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MECHANISM OF P-AMINO BENZOIC ACID ACTION AND THE PARALLEL EFFECTS OF ETHYL CARBAMATE (URETHANE)*

IN seeking a theoretical basis for the bacteriostatic effects of sulfanilamide, Woods and Fildes^{1,2} first postulated that the drug competed with a structurally related molecule, para aminobenzoic acid (PAB), which was thereby presumed to occupy some essential rôle in the normal growth and metabolism of micro-organisms. The latter compound thus has a dual interest: as a possible intermediary in ordinary metabolism and as a possible site of sulfanilamide inhibitions. Numerous investigations seem to have provided evidence supporting both aspects of the original hypothesis, and to have greatly extended the biological significance of PAB.

It now appears widely accepted that PAB is not only a naturally occurring "essential metabolite,"³ but an anti-sulfanilamide or a growth factor for diverse organisms, including chicks,⁴ dermatophytes⁵ and even autotrophic plants, *e.g.*, diatoms.⁶ The same compound is thought to be concerned in lactation⁷ and in pigmentation of hair.⁴ Its anti-sulfanilamide effects on the growth of bacteria have been demonstrated *in vivo*⁸ as well as *in vitro*.¹ Doubt has been expressed, however, that this anti-sulfanilamide effect is in the nature of a competitive action of the two molecules for the same receptor in the organism, since 1 molecule of PAB may antagonize 23,000 molecules of sulfanilamide. Before the above-mentioned interpretations become too deeply entrenched in the scientific literature and thought as fully correct, an alternative explanation for the mode of sulfanilamide action, as well as the stimulatory effects of PAB, should be considered.

Recent experiments in this laboratory have shown

* The studies in this laboratory have been aided, in part, by a grant from the Penrose Fund of the American Philosophical Society.

¹ D. D. Woods and P. Fildes, *Chem. Ind.*, 59: 133, 1940.

² D. D. Woods, *Brit. Jour. Exp. Path.*, 21: 74-90, 1940.

³ S. D. Rubbo and J. M. Gillespie, *Nature*, 146: 838, 1940.

⁴ S. Ansbacher, *SCIENCE*, 93: 164, 1941.

⁵ N. S. Dimond, *SCIENCE*, 94: 420, 1941.

⁶ S. Wiedling, *SCIENCE*, 94: 389, 1941.

⁷ B. Sure, *SCIENCE*, 94: 167, 1941.

⁸ G. M. Findlay, *Brit. Jour. Exp. Path.*, 21: 356, 1940; F. R. Selbie, *ibid.*, 21: 90, 1940.

that ethyl carbamate (urethane) as well as PAB may exert anti-sulfanilamide effects on luminous bacteria. The results are more striking in relation to luminescence than to growth, although both are influenced. The structural similarities between the molecules of urethane and sulfanilamide are so remote as to rule out competitive action, and urethane could hardly be considered an "essential metabolite." It is a familiar principle, however, that narcotics and, indeed, poisons of many sorts, have stimulatory effects in low, and inhibitory effects in high concentration. All three of the above compounds—urethane, PAB and sulfanilamide—act in the manner of narcotics on luminous bacteria, stimulating growth and luminescence in low, while inhibiting in high concentrations.

Further evidence of the fundamentally narcotic action of PAB, sulfanilamide and urethane, quite apart from growing cultures, is found in their effects on washed cell suspensions. The intensity of luminescence is readily and reversibly reduced on the addition of any one of these or a host of other narcotics. Experiments with the luminescent luciferin-luciferase system, which can not be extracted yet from bacteria but can be obtained in purified preparations from *Cypridina*⁹ have shown that the velocity constant of the reaction *in vitro* is retarded by urethane, PAB, sulfanilamide, sulfapyridine and sulfathiazol. The action is reversible and clearly on the enzyme, luciferase. Over a wide range it is independent of the substrate (luciferin) concentration.¹⁰ Thus, the inhibitory effects of PAB, urethane and sulfonamides appear to be definitely related to those of narcotics in general. Recent work with hydrostatic pressure and temperature¹¹ has opened a new approach to the study of the basic mechanism involved.

The stimulatory action of narcotics in low concentration is not easy to explain. In the present connection, the point to be emphasized is that the stimulatory effects of one narcotic may antagonize or completely overcome the inhibitory effects of another that is simultaneously present. If the inhibitor is sulfanilamide, the antagonist is naturally looked upon as "anti-sulfanilamide." The anti-sulfanilamide action of both urethane and PAB might well belong in this category. The molecular structure of the antagonistic narcotics need not be closely related, as would be required for competitive inhibition in the physicochemical sense. The action of urethane and of nembutal in preventing death from sulfonamide overdosage of animals¹² lends support to the view ex-

⁹ E. N. Harvey, *Erg. d. Enzymforsch.*, 4: 365, 1935; R. S. Anderson, *Jour. Cell. Comp. Physiol.*, 8: 251, 1936.

¹⁰ F. H. Johnson and A. M. Chase, *ibid.*, in press.

¹¹ F. H. Johnson, D. E. S. Brown and D. A. Marsland, to be published in the near future.

¹² R. K. Richards, *Jour. Lab. Clin. Med.*, 26: 1256, 1941.

pressed above, although its possible significance in relation to the mechanism of sulfanilamide and PAB effects has apparently been overlooked. Other examples of antagonisms among narcotics could be cited. The whole problem needs further study.

In summary, both the stimulatory and inhibitory effects of PAB and sulfanilamide, as well as urethane, appear to be fundamentally related to the general problem of narcotic action, which does not necessarily

involve a structural similarity between the molecules of the inhibitor and an intermediary of normal metabolism in the cell. This interpretation has some interesting implications with respect to the various effects of PAB in different organisms referred to above. Further study from the point of view discussed would appear justified on the basis of the evidence at hand.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A HEAD HOLDER FOR INTRACRANIAL OPERATIONS ON THE MONKEY

THE advantages of fixation of the head, apparent to any one undertaking intracranial operative procedures in experimental animals, are readily secured in carnivores by use of the Czermak type head holder. Adaptation of the Czermak holder for employment with monkeys has not proved satisfactory in our hands, and we have thought it worth while briefly to describe the apparatus devised for that purpose in this laboratory.

The essential instrument is the head holder (A) invented some years ago by Dr. A. R. Buchanan for use with the Horsley-Clarke machine on guinea pigs (Fig. 1). This consists of a cylindrical cross-bar (1) and two side arms (2) which slide onto the bar and can be tightened in place by set screws (3). The cross-bar is slotted and an interlocking piece fitted on the interior of the base of each arm, in order that the arms be aligned in the same plane. When employed with the stereotaxic instrument on the guinea pig, the Buchanan holder is applied by approximating the two arms until the shaped pins (4) fit into the meatuses. Finally the ear bars of the Horsley-Clarke machine are seated in the openings (5). When the Buchanan holder is used to fix a monkey's head, the ear plugs (D) are firmly inserted into the meatuses; these are the short, straight plugs described by Harrison.¹ The side arms are then approximated until the shaped pins are solidly set in the open ends of the ear plugs, and the arms held in place by tightening the set screws. Dorso-ventral rotation of the animal's head is prevented by introducing into the opened mouth a straight bar covered with rubber tubing (E), and making this fast on the side arms by the use of two common right angle clamps (C), as illustrated in the lower figure.

As shown by the sketch of the apparatus set up for operation, the Buchanan holder can be attached to a vertical bar (F), arising from the table, and adjusted to a convenient height by any suitable clamp. We have employed a universal clamp (G) to allow tilt-

ing to either side. For approaches through the convexity of the calvarium no further fixation of the head is needed. In lateral approaches involving exposures down to the zygoma, the distal part of the side arm forms an inconvenient bulge beneath the drapes.

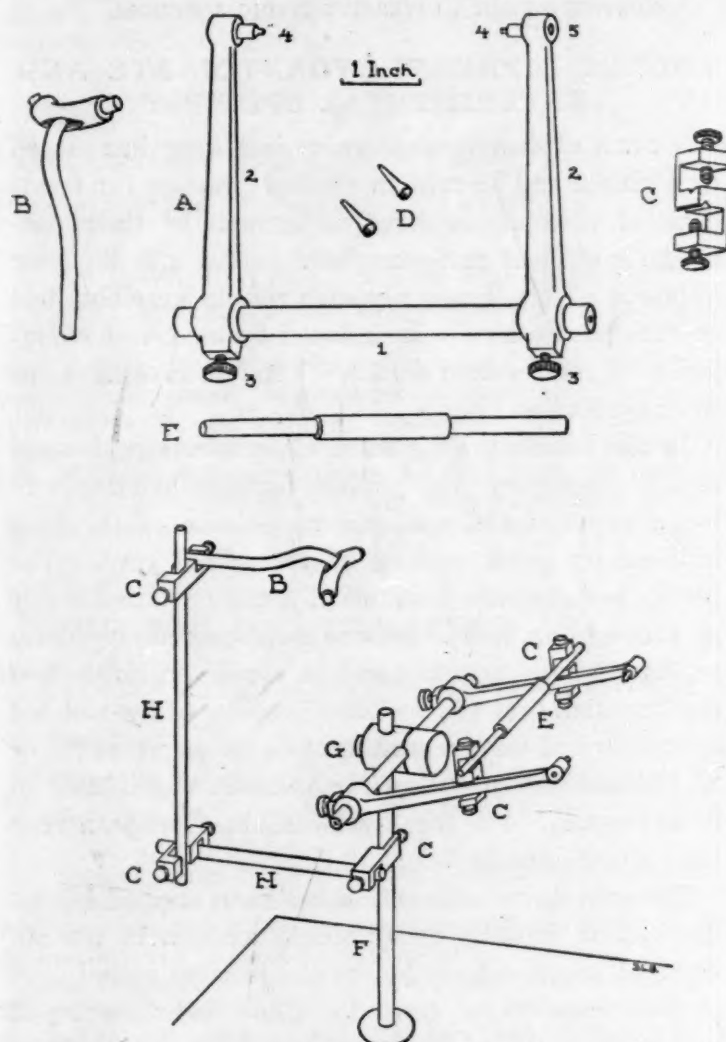


FIG. 1.

This might be obviated by constructing a side arm containing a right angle or one made so that it would lie flush with the ear.

For approach to the posterior fossa through the enlarged foramen magnum, we have found it necessary further to stabilize the head to prevent its dorsiflexion. For this purpose a simple nose piece (B) was contrived, the cross-bar of which, covered with

¹ F. Harrison, *Arch. Neurol. Psychiat.*, 40: 563, 1938.

rubber tubing, fits across the nose immediately below the eyes. As demonstrated in the figure, the nose piece can be mounted from the vertical rod (F) by means of two straight bars (H) and three right angle clamps (C). For the posterior approach the Buchanan holder is turned in the universal clamp until the side arms of the holder are almost vertical, in order to obtain proper exposure of the operative site. The nose piece (B) can then be adjusted.

The Buchanan holder in the size shown accommodates monkeys weighing up to 4 kilograms and, used without ear plugs, is also satisfactory for guinea pigs. In neither the monkey nor the guinea pig does the apparatus rupture the tympanic membrane or do apparent injury to the external ear.

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SODIUM DIPHENYLHYDANTOINATE AND EXPERIMENTAL EPILEPSY

SODIUM diphenylhydantoinate is a drug introduced by Putnam and Merritt in clinical practice for treatment of epileptic seizures on account of their particularly efficient anti-convulsant action with the least hypnotic effect. Primarily such results were obtained on cats with convulsions induced by electrical stimulation of the cerebral cortex.¹ Clinical investigations were performed later.²

In this article are discussed experiments performed in our laboratory with sodium diphenylhydantoinate in an experimental epileptiform seizure of the frog induced by quick cooling of the spinal cord. The results reported are a résumé of a more detailed paper in preparation.³ The technic employed was recently reported^{4,5} and now is usual in our laboratory. For the Brazilian frog (*L. ocellatus*) cooling of the isolated spinal cord of the preparation to a temperature below 8° C. produces an epileptiform seizure which lasts 20 to 40 seconds. For the American and European frog the cooling must be below 0° C.

The anti-convulsant action has been studied injecting sodium diphenylhydantoinate solution in the abdominal lymphatic sac before the isolated spinal cord preparations were started. The doses employed varied from 0.05–0.90 grams per kilogram of body weight. Doses from 0.05–0.09 grams did not avoid the production of the attacks, but sometimes they

were less severe. Doses greater than 0.10 grams per kilogram commence to hinder the production of the convulsions and 0.15 grams prevent the epileptiform seizure in nearly all the frogs injected. This anti-convulsant effect was observed with no hypnotic effect, the frog jumping quite well in the laboratory. When the medulla was sectioned and the isolated spinal cord prepared, the flexor reflexes of the legs were as in the normal preparations. Such anti-convulsant action is still observed after 2 days elapse between the injection of the sodium diphenylhydantoinate and the cooling of the spinal cord. Hypnotic effects were obtained only with doses superior to 0.20 grams per kilogram. The lethal dose has not been determined, being superior to 0.90 grams.

Sodium diphenylhydantoinate acts on the spinal cord of the frog, hindering the epileptiform seizures induced by quick cooling with no hypnotic effects and disturbances of the spinal reflexes.

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- Anales de la Escuela Nacional de Ciencias Biológicas*, Volume II, Numbers 1, 2 and 3. Symposia. Pp. 371. Illustrated. Secretaria de Educacion Publica Instituto Politecnico Nacional, Mexico.
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² Medical fellow of the National Research Council.

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³ H. Moussatché, *Rev. Bras. Biol.*, in press.

⁴ M. Ozorio de Almeida, *C. R. Soc. Biol.*, 115: 78, 1933.

⁵ M. Ozorio de Almeida, H. Moussatché and M. V. Dias, *Rev. Bras. Biol.*, 2: 179–194, 1941.

McGraw-Hill Books of Unusual Interest

Mathematics for Electricians and Radiomen

By NELSON M. COOKE, Chief Radio Electrician, United States Navy. 616 pages, 6 x 9. \$4.00

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By J. L. SYNGE and B. A. GRIFFITH, University of Toronto. 506 pages, 6 x 9. \$4.50

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This well-known text has been brought up to date and almost entirely rewritten in accordance with recent advances in atomic theory and in the physics of the nucleus and of fundamental particles. The double process of shortening existing material and of modernizing the viewpoint has resulted in a text admirably adapted to the requirements of the student who wishes to obtain a correct perspective of the growth and present trend of physics as a whole.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE NAME OF THE KERST X-RAY MACHINE

THE name of the latest machine for producing powerful radiation, the device that promises to rival the famous cyclotron in atom-smashing, is under discussion.

Announced as the "rheotron," it is also being called the "betatron." Built by the General Electric Company, the invention of Dr. Donald W. Kerst, of the University of Illinois, "betatron" is now in the lead as it is the pick of Dr. Kerst. The 20,000,000-volt doughnut-shaped electron whirling x-ray machine has been removed to the University of Illinois while the General Electric Company constructs a 100,000,000-volt machine of the same kind.

The name rheotron derives from the Greek word rheo which means to flow. And the machine does cause electrons to flow. But the cyclotron, invented by Professor E. O. Lawrence, of California, also causes protons and other heavy atomic particles to flow, so that the name rheotron could appropriately apply to both. So could the name cyclotron, since each machine causes flow in circles.

The distinguishing feature of the new machine is that it whirls electrons, the lightest constituents of the atom, while the cyclotron whirls the heavy parts. This distinction is emphasized in the name betatron, because "beta rays" was the name given to the electron rays of radium. In the same way the name "alphatron" might be given to the cyclotron because "alpha rays" was the name given to the heavy particle radiation from radium. However, these rays consist only of alpha particles which are the kernels of helium atoms, whereas the cyclotron will whirl any heavy particle that has a positive charge.

Radium also gives off gamma rays which are similar to x-rays but more penetrating or "harder" than are produced by the usual x-ray machine. Cosmic rays produce gamma rays that are harder than any that have yet been produced artificially.

The 20,000,000 volts of the betatron, more than twice the voltage of any previous electron accelerator, imparts to its electrons a higher speed than any ever before obtained artificially. When these electrons strike a target, they produce x-rays more penetrating than those of radium.

FIBER, DRUG AND OTHER PLANT PRODUCTS GROWN IN THE UNITED STATES

MANILA is cut off temporarily, but the United States is still able to get at least a certain amount of Manila hemp for necessary naval cordage. Thanks to botanical research conducted in the U. S. Department of Agriculture in peace years, wartime supplies of a number of formerly imported plant products are getting on a basis of home, or at least Hemisphere, production, according to Dr. E. C. Auchter, chief of the Bureau of Plant Industry, in his annual report to the Secretary of Agriculture.

The abaca plant, from which Manila hemp is made,

has been brought into fairly large-scale production in Central America, and a great increase in acreage is expected for the current year. Other problems in plant production which were at least partly solved by research conducted before the outbreak of war include:

Development of cotton varieties with extra-long staples formerly imported from Egypt, now grown in our Southwest. These cottons are valuable in making fabrics for parachutes and other aviation uses.

Fiber flax, at one time almost out of cultivation in the United States, now staging a comeback, thanks to improvements, especially in the direction of disease resistance.

Introduction of drug plants. Normally unprofitable because of competition of low-cost hand labor abroad, they now command high enough prices to repay cultivation under American conditions. It is estimated that the addition of a mere 3,500 acres in assorted drug plants will take care of our ordinary needs.

New soil-building plants, notably grasses and legumes to recondition exhausted soils and check the progress of erosion.

Cultivation of rubber in the American tropics has been much talked of, but it must be recognized that this program is a long-time one, and that benefits will accrue in the post-war period rather than during the immediate emergency. However, the department obtained about a million choice rubber seeds out of the Orient just in the nick of time, and these are now coming along in nurseries in suitable spots in Central and South America.

PLANTING SUGAR BEETS

LESS of the heavy "stoop" labor which has always been held against the beet sugar industry, and more sugar production for a country and a world at war, are promised by a curious turn of invention which will be widely used throughout the immense sugar-growing area of the western United States in 1942.

Incidentally the industry has profited from a hard lesson which it learned in 1915-18, when every pound of beet seed came from abroad. Huge seed plantations were maintained, and every pound planted in the United States is now raised here at home.

The beet seed ordinarily grows from two to four germs, in a single woolly outside covering. Until a year or so ago, it was necessary to plant these hulls whole. This meant that the young beets came up two to four in a clump, and in a virtually solid row like young lettuce. Since the optimum space between beets is about a foot, this in turn meant that thousands of people, mostly Mexicans, had to crawl along the rows and, by hand, separate the clumps and pull out the surplus beets.

Roy Bainer, a research associate of the U. S. Agricultural Experiment Station at Davis, Calif., and his associates there worked out a process to "crack" the woolly hulls and thus release the single seed-units for planting singly. The process consists essentially of pass-

ing the seeds between a disk and a moving belt. It required delicate adjustment to "crack" the hulls without damaging the seed-units. But it has been done.

The result is that farmers can now plant beet seeds easily, with the aid of new planting machinery which is also being developed, and though they can not quite plant them just where they want them, they can plant them far enough apart so that men with long-handled hoes can now pass rapidly along the rows and deftly strip the unwanted beets out of the soil. A man can now strip thin beets up to an acre a day.

There will be thousands of pounds of "singled seed" planted next spring. Demonstrations were conducted all over the beet country this year under the auspices of the beet-sugar companies.

GUAYULE RUBBER

GUAYULE rubber's relatively high resin content, hitherto a handicap in the use of this native American plant source, figures as a possible actual benefit if the proposed large-scale production of synthetic rubber is carried through.

Tire-making and other rubber-processing machinery is not for handling natural Hevea rubber, which normally has a resin content of about five per cent. Synthetic rubber contains no resins at all, and if it is to be processed by the same machines, resins must be artificially added—a somewhat expensive process. On the other hand, raw guayule rubber has a resin content ranging from 15 per cent. to 18 per cent., which must be reduced to the five per cent. of Hevea rubber before processing—again at some expense. However, if the low-resin synthetic rubber is blended with the high-resin guayule product in the right proportions, the blend becomes the equivalent of natural rubber from the East Indies without additional expense.

Since neither synthetic nor guayule rubber is now being produced in even a small fraction of the national needs, the proposal to establish huge synthetic plants and the bills now before Congress for setting up a 45,000 acreage in guayule, sponsored respectively by Senator Downey and Representative Anderson (both of California), become in a sense mutually complementary. This is true even in the matter of timing, for it is expected that it will take about two years to get the synthetic plants into production—and it takes two years to bring a crop of guayule to harvest.

Other proposed sources for home-grown American rubber offers less promise than guayule. There is rubber in various species of milkweed, spurge and goldenrods publicized by the late Thomas Edison, but the content is low and there are difficulties in extraction, usually involving the development of special machinery.

Much has been said lately about a Russian dandelion called kok-sagyz, but preliminary investigations by the U. S. Department of Agriculture have not yielded any encouragement. Kok-sagyz plants yield only about one per cent. or two per cent. of rubber, as compared with the 15 per cent. to 20 per cent. possible from guayule. It is estimated that something over 45 million acres of kok-sagyz would be necessary to supply the normal Amer-

ican demand. The Soviets are believed to be concentrating on kok-sagyz only because experimental plantings have shown that while guayule plants will grow in Russia's semi-arid regions they will not develop high rubber content because of different climatic conditions.

Kok-sagyz, incidentally, is a true dandelion, belonging to the same genus as our common yellow-flowered pest. Its botanical name is *Taraxacum kok-sagyz*; the technical name of the common dandelion is *T. officinale*.—FRANK THONE.

GERMANY'S WAR MATERIALS

A REPORT made public by the Department of the Interior summarizes Germany's war materials acquired during the past eight years through purchase, aggression and internal effort. According to this report, prepared by Charles Will Wright, foreign minerals specialist of the Bureau of Mines, "in the case of aluminum and magnesium, the metals so essential to the manufacture of airplanes and incendiary bombs, Germany was out-producing the United States, Great Britain and Canada up to 1941. By the end of 1941, it was expected that the combined aluminum output of the three allied countries would pull ahead of the German-dominated nations, and that the Allies' 1941 figures would be nearly doubled by the end of 1942. In the case of magnesium, it is believed that American and British output is now equal to German production, while American output alone by 1943 will be more than four times Germany's expanded 1941 production."

Mr. Wright states, however, that mineral production for non-defense purposes in the United States still goes on, even since December 7, and that "Just when the United States and Great Britain will be able to exceed the German production of these war machines (tanks, submarines and munitions) depends largely on their ability to increase and maintain mineral production and the extent to which civilian consumption is curtailed to permit more rapid advances in the manufacture of required war materials."

It is reported that Germany lacks "copper, tin, tungsten, nickel and petroleum, but that there is no immediate prospect of a collapse of the military machine because of shortages of any of these materials."

According to Mr. Wright, German possession of the Near Eastern oil fields would assure ample petroleum oil for all essential needs if transport and reconstruction problems were solved.

PITCH THE BEST INCENDIARY EXTINGUISHER

HARD coal-tar pitch, granulated or flaked, will extinguish a magnesium incendiary bomb by forming an airtight blanket which quickly smothers the flame.

According to Dr. R. R. Sayres, director of the U. S. Bureau of Mines, the pitch is the best known extinguisher—better than sand or water or even prepared compounds such as carbon tetrachloride, carbon dioxide and foam.

The pitch, sometimes called "fuel-pitch," will soften

at about 300 degrees Fahrenheit. It is suggested that 25- or 50-pound lots be stored in boxes or bags with long-handled shovels kept near-by.

Directions given by the Bureau of Mines follow:

A slightly different procedure is followed in extinguishing incendiary bombs falling on wood surfaces and those falling on concrete or metal, according to the Bureau of Mines. In either case, it is necessary to wait about a minute for the thermit to burn itself out before trying to extinguish the bomb.

In dealing with a bomb on concrete or metal, use a shovel or scoop to spread—not throw—a layer of pitch over it. If a short flame persists, apply another layer of pitch and allow it to cool ten minutes before removing it from the house or office in a bucket or metal container. Although the bomb may continue to smoke for a few minutes, it will not burn again because the pitch encircles it in an airtight blanket, shutting off its necessary oxygen supply.

To extinguish a bomb on a wood floor such as an attic, cover the bomb with a layer of pitch to stop the heat and glare. Then spread a layer of pitch on the floor near-by, rolling the bomb with a long-handled shovel or hoe on to this layer and covering the entire mass with more pitch. This is necessary because the burning bomb can get air through the pores and cracks of the wooden floor. Fires already started in wood or other near-by combustible material by the bomb may be put out with water or prepared chemicals, taking care not to direct such a stream on the bomb itself. A bomb rolled in pitch this way is completely extinguished and does not have to be removed from the building immediately. After the pitch has cooled sufficiently to handle, it can be removed simply by rolling it up like a carpet.

Because some incendiary bombs contain mild explosive charges which hurl small fragments, the bureau recommends that protective clothing and goggles be worn and that long-handled implements be used in dealing with a magnesium bomb. One of the best protective measures for a householder is to remove all paper boxes and inflammable material from the attic and cover the floor with sand, or sheet metal.

SNOW-WHITE MOUNTAIN GOATS

For the first time in the history of modern game management, wild mountain goats have been successfully trapped, transported and transplanted. To the state of Montana goes the honor for capturing ten of the snow-white crag climbers on the Lewis and Clark Forest and subsequently transporting them several hundred miles to the Crazy Mountains north of Livingston, Mont., before liberating them.

Native mountain goats are true dwellers of the high country, spending a large portion of their lives high above timber line. Claimed by many to be the most agile of beasts, the mountain goat is capable of unbelievable endurance at an amazing clip across the jagged, rocky slopes. Its small, sharp and slightly curved horns are as black as its pelt is white. For centuries the mountain goat has been without peer as a game animal, its rocky

fortress sufficing as protection against the most accurate of modern armament.

Within the last few decades it has become increasingly necessary to offer mountain goats sanctuary from a fast multiplying army of hunters. In many places they have become extinct. It was to such a place that the Montana Fish and Game Department transported the undomesticated nannies and billies, the largest of which weighed 142 pounds.

It is anticipated that the present nucleus may some day furnish a population of sufficient size to permit hunting. If, however, the small herd merely perpetuates itself without increasing its number, the game managers will consider the job well done. Though the trapping and transportation ran close to \$35 per animal, the preservation of the species for future Americans to see in its native haunts is considered worth many times that price.

ITEMS

TYPHOID deaths reported in 1940 of 78 United States cities surveyed since 1910 was only 172, the lowest number on record, according to the *Journal of the American Medical Association*. This report is on the basis of the 1940 census and information from city health officers. The *Journal* states that the rate for all cities is now "just about one half of one point per hundred thousand of population." No typhoid outbreaks have been recorded.

SPECIAL foods for middle-aged and aged people may be the next step in nutrition, according to a food survey reported to the American Chemical Society by Dr. William A. Hamor, associate director of the Mellon Institute of Industrial Research, Pittsburgh. "New advances have been made in infant feeding and the nourishing of 20,000,000 school children. With less than 2,000,000 babies born a year, infant-food manufacturers are extending their markets with lines of products for older children. It has predicted that the next step may be foods especially for the middle-aged and aged."

SULFATHIAZOLE ointment cured impetigo in roughly a third of the twelve to sixteen days usually required under other means of treatment, in a series of 60 cases reported in the *Journal of the American Medical Association*. The cases are reported by Dr. L. H. Winer and Dr. E. A. Strakosch, of Minneapolis. They found the sulfathiazole ointment apparently safe and "more agreeable and cleaner" than ammoniated mercury ointment, cinnabar lotion, gentian violet or silver nitrate solution. None of these treatments has been found wholly satisfactory, hence Drs. Winer and Strakosch propose the use of sulfathiazole ointment in the treatment of impetigo.

"WU WU" is not always a youthful exclamation of breathless amazement. It has a more serious side, and as such is listed among several thousand terms in a new "Dictionary of Philosophy," edited by Dagobert D. Runes, published by the Philosophical Library. "Wu wu: To regard things as things, that is, to regard things with objectivity and no attachment or selfishness, on the one hand, and with the conviction that the self and the non-self form an organic unity on the other."